Rock Products

and CEMENT and ENGINEERING NEWS (Est. 1896)

THE OLDEST PUBLICATION IN ITS FIELD AND THE RECOGNIZED AUTHORITY

POLITICS and BUSINESS

WE are in the midst of one of the bitterest and most vehement political campaigns in recent history.

BUSINESS and industry are more than ordinarily involved because it is being made to appear that private business and business profits are objects of direct attack.

DISCOUNTING a great deal of political ballyhoo there probably is an issue of fundamental approach, although there is not so great a difference in objectives as some would make it appear.

ALL intelligent business men probably would admit that many problems of economics, or political economy, which vitally affect business and industry, are too comprehensive to be solved by individual business men actuated only by self-interest—as they were for many years.

GOVERNMENT must play an increasingly important part in co-ordinating such individual business activities; not for purposes of political capital, but because advance in civilization demands it.

WE think that business brains are better qualified to work out solutions to these problems than politicians' brains; we think that politicians and statesmen will eventually come to that conclusion themselves; even the college-professor type of politician will learn by experience.

MANY of the "radical" ideas that have been put into practice in the last three years, with more or less success, are aimed at the management of business and industry, to make it more conscious of the public welfare—reforms that most public-spirited business men would admit are needed.

SO, while we will and should hold different views as to the effectiveness, or even the saneness, of some of the methods employed, we should not lose sight of the fact that both, or all, political parties are being carried along by a current of popular ferment, which grew out of the recent lack of coördination of business and industrial activities and policies.

TO our mind voluntary co-operation of business men, with a pooling of their intellectual faculties for the common welfare, is far superior to a system of collectivism directed by a central government, which, with all due deference to its aggregate intellectual capacity and honesty, is not capable of directing industry with practicality.

HOWEVER, as yet, business men have still to demonstrate that they can co-operate with sufficient unanimity of purpose, and with enough subordination of individual self-interest, to accomplish results which the people seem to believe only the government can accomplish. The government cannot accomplish them, without wrecking much that we dearly cherish, we truly believe, and so do most of you; but just now we are a minority, probably, and must adjust ourselves to continued government experiments in industry regulation, whichever political party may be in power. At the same time, more of our own efforts should be directed toward co-operation both among ourselves and with the government to satisfy a popular demand for "the more abundant life."

THE EDITOR

TWO NEW NORTHWESTS

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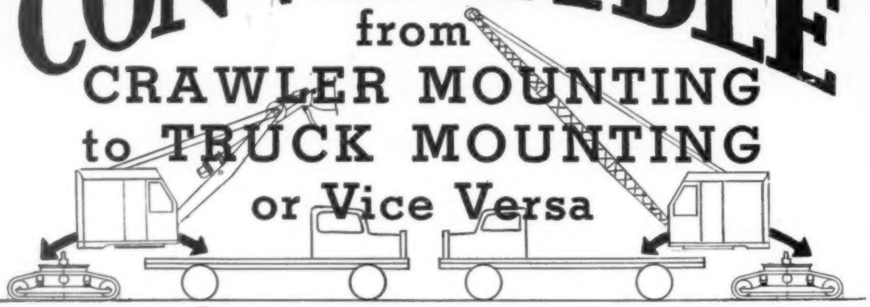
from CRAWLER MOUNTING to TRUCK MOUNTING or Vice Versa



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MODEL 18
1/2 YARD CAPACITY

Designed for high speed portability and output!

IN no other machine of 3/8 or 1/2 yd. capacity are the advantages of the design and construction of larger machines so fully incorporated as on the Northwest Models 15 and 18.

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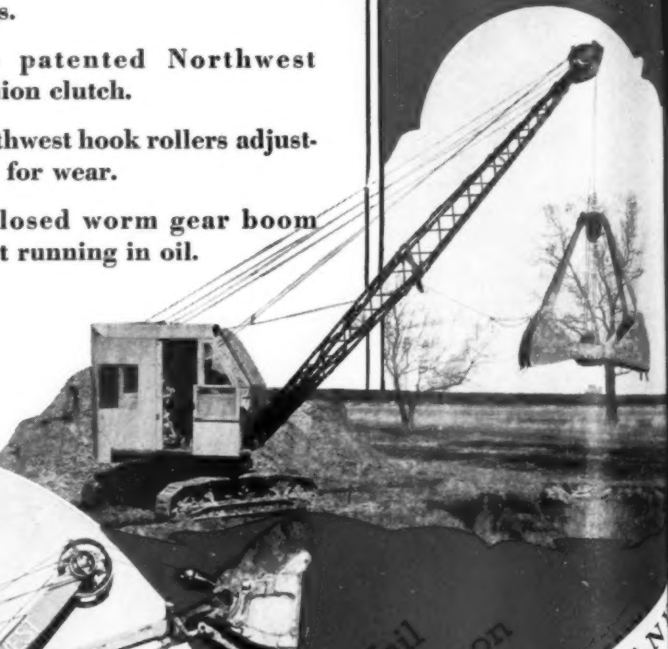

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(Published Monthly)

July, 1936

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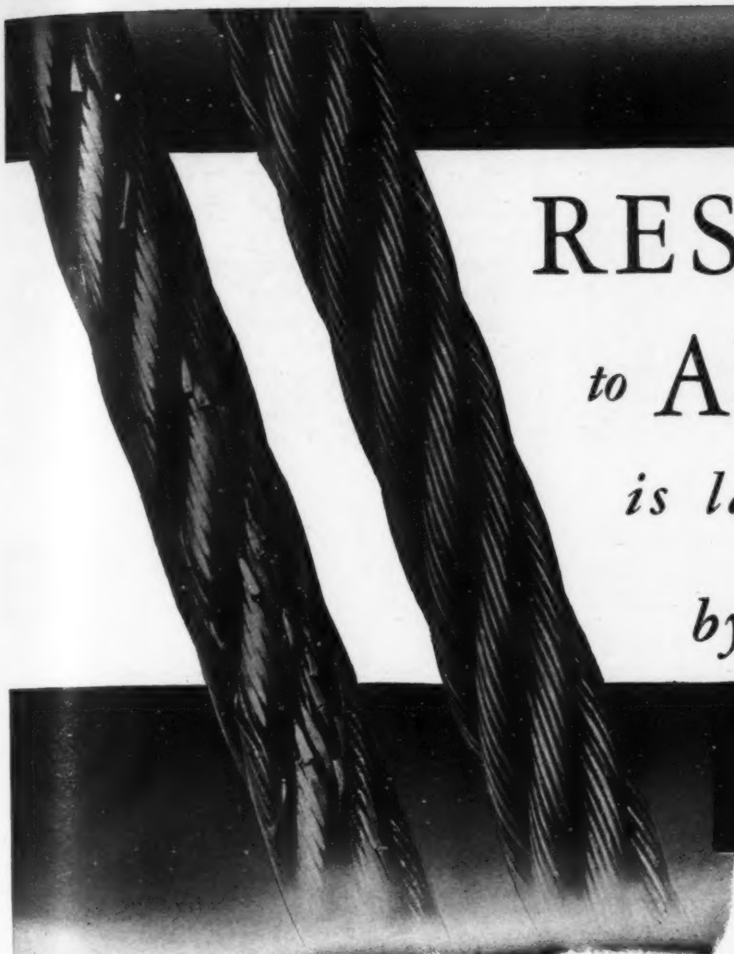
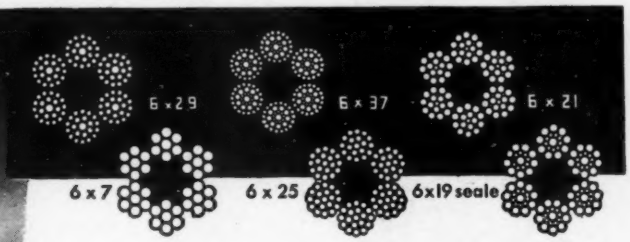


RESISTANCE *to* ABRASION *is largely determined by* DESIGN



Select the Rope that Fits Your Job

When resistance to abrasion is the primary characteristic you demand in wire rope, select a rope with strands composed of few but heavy outside wires. Bear in mind, however, that the heavier the outside wires the less the rope is able to resist damage from bending. If wire rope in your particular service is subjected to both abrasion and frequent bending, it is wise to study the degree that each exerts as a destructive influence. The selection of a rope design that compromises resistance to abrasion with resistance to bending in the degree each occurs, will result in the longest possible rope life. Further information on this subject will be gladly sent to you upon request.

●

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Please send me reprints of previous advertisements which tell "How to make Wire Rope last longer".

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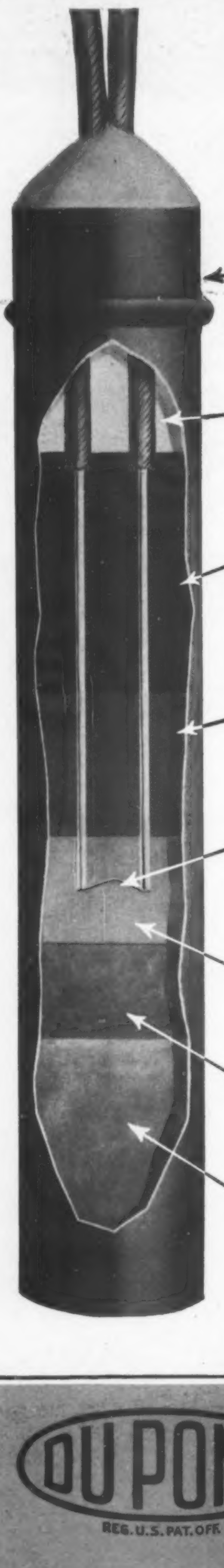

CROSS SECTION SHOWING STURDY, DEPENDABLE CONSTRUCTION

COPPER SHELL
Carefully annealed to prevent cracks. Dipped in lacquer before loading for detection of "pin holes."

SULPHUR SEAL
Specially compounded sulphur. Will not corrode copper nor eat insulation on leg wires.

WATERPROOFING
Efficient waterproof compound. Sticks to shell and leg wires, thus preventing moisture from creeping along leg wires and shell. Will not shrink in cold.

PLUG
Holds leg wires precise distance apart, relieving possible strain on bridge wire.

BRIDGE WIRE
Amazing example of precision manufacture. *Fifteen ten-thousandths* of an inch in diameter. Composed of four alloys to give right resistance to assure positive, dependable detonation.

IGNITION CHARGE
Ignites when bridge wire fuses. Will not corrode bridge wire, soldered joints or leg wires.

PRIMING CHARGE
Dense, powerful explosive that insures detonation of base charge at maximum velocity.

BASE CHARGE
Detonates at highest velocity of any commercial explosive.

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Insure Complete Detonation of Your Shots

MONEY and time are required to prepare a shot. Don't risk losing both. Use an electric blasting cap that insures a complete detonation.

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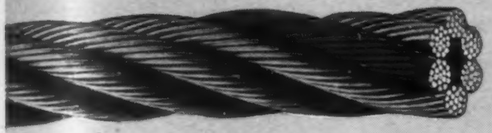
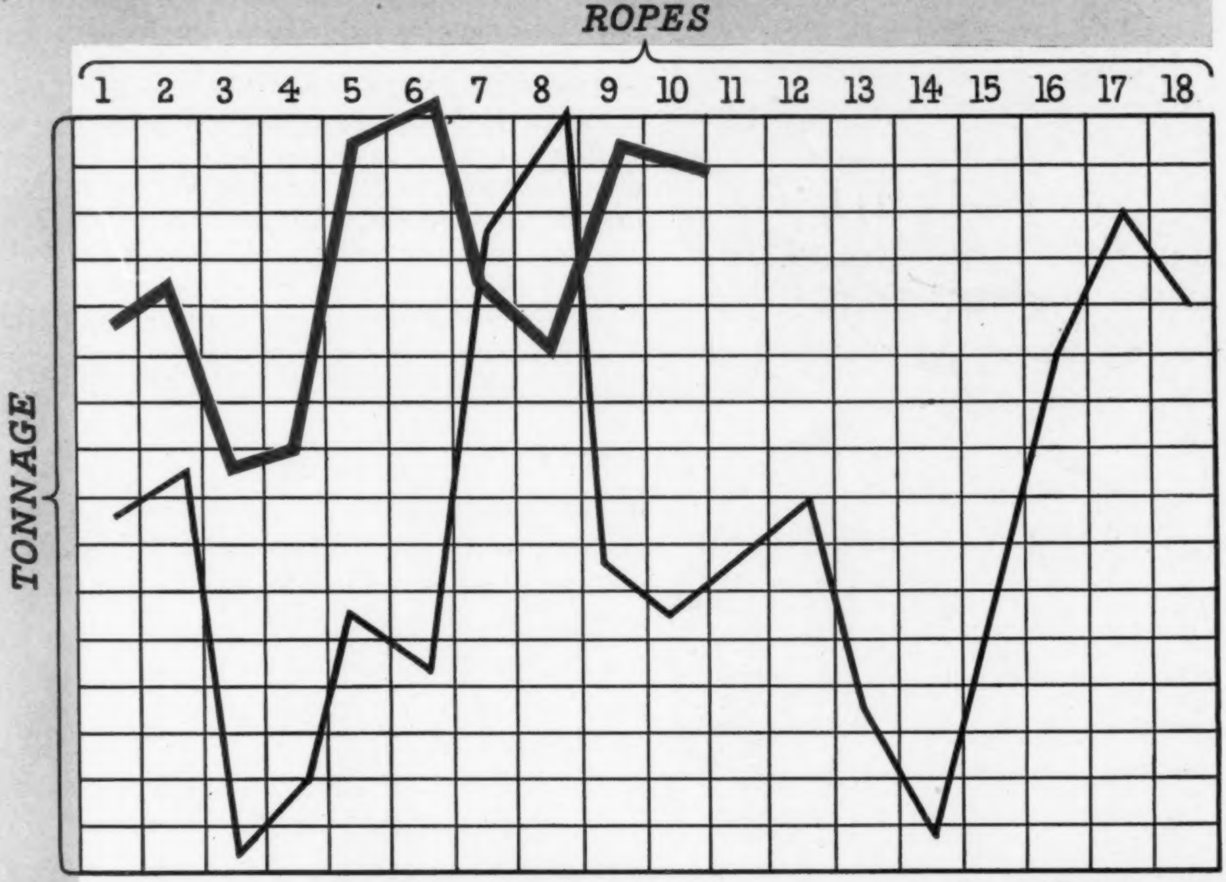
A study in wire rope service . . .



CONSISTENCY



TRU-LAY PREFORMED ROPES — NON-PREFORMED ROPES

● Here is a graph that visualizes the *consistency* of TRU-LAY Preformed Wire Rope service.

The chart was taken from records of a large mid-western coal mine covering 18 non-preformed wire ropes and 10 TRU-LAY Preformed wire ropes. All ropes worked under identical operating conditions; were the same size, construction, lay and grade.

The ten TRU-LAY Preformed ropes gave an average service of far greater than the 18 *non*-preformed ropes.

TRU-LAY Wire Rope in operating service invariably gives increased tonnage and is more consistent in its service because it is preformed. Preforming makes a more uniformly high quality rope—for practically every job. And TRU-LAY is preferred because it is preformed by the American Cable Company.

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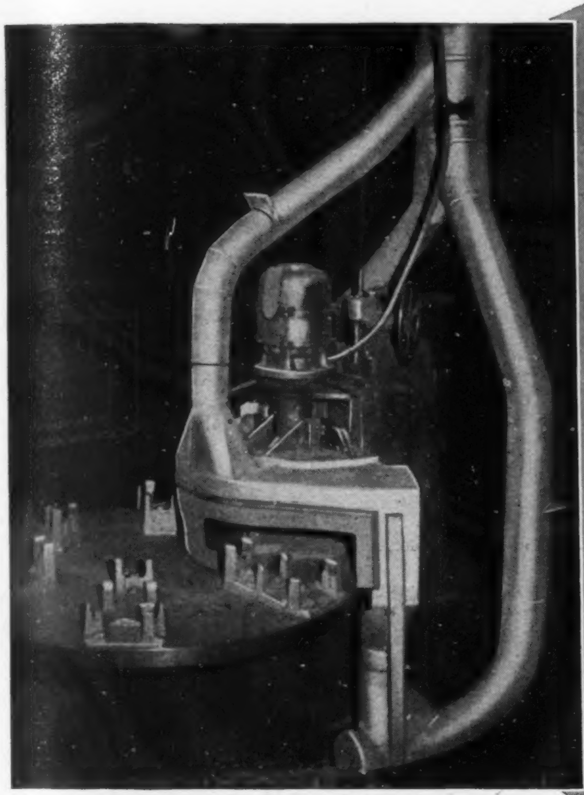
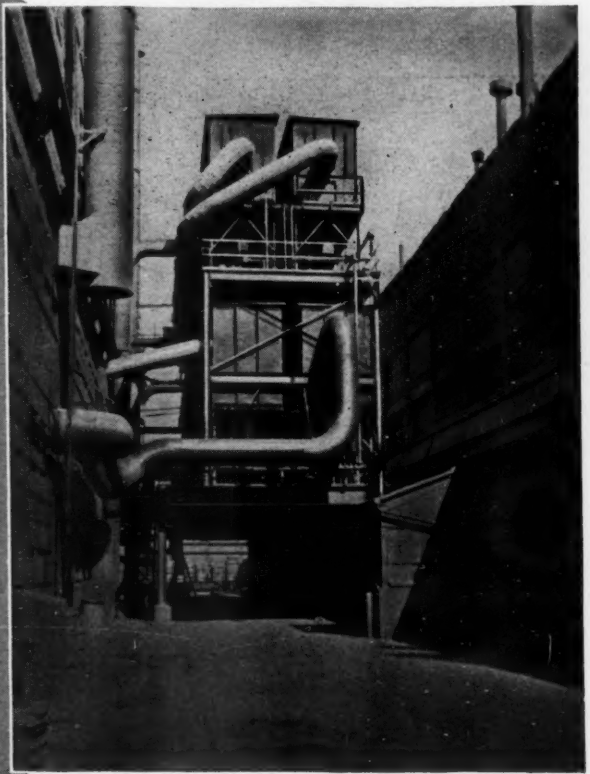
Proper attention to detail marks the difference between *complete* and partial dust control. The handling of details to a successful conclusion without any false starts is the work of long experience with dust conditions. Blaw-Knox Engineers have such experience and furnish ideas for solution of simple as well as difficult dust problems.



ONE OF THE SMALL DETAILS THAT DISTINGUISHES BLAW-KNOX SERVICE
A typical Blaw-Knox answer to precision in detail is this hood that draws air from above and below the grinder for complete control of a dust nuisance.



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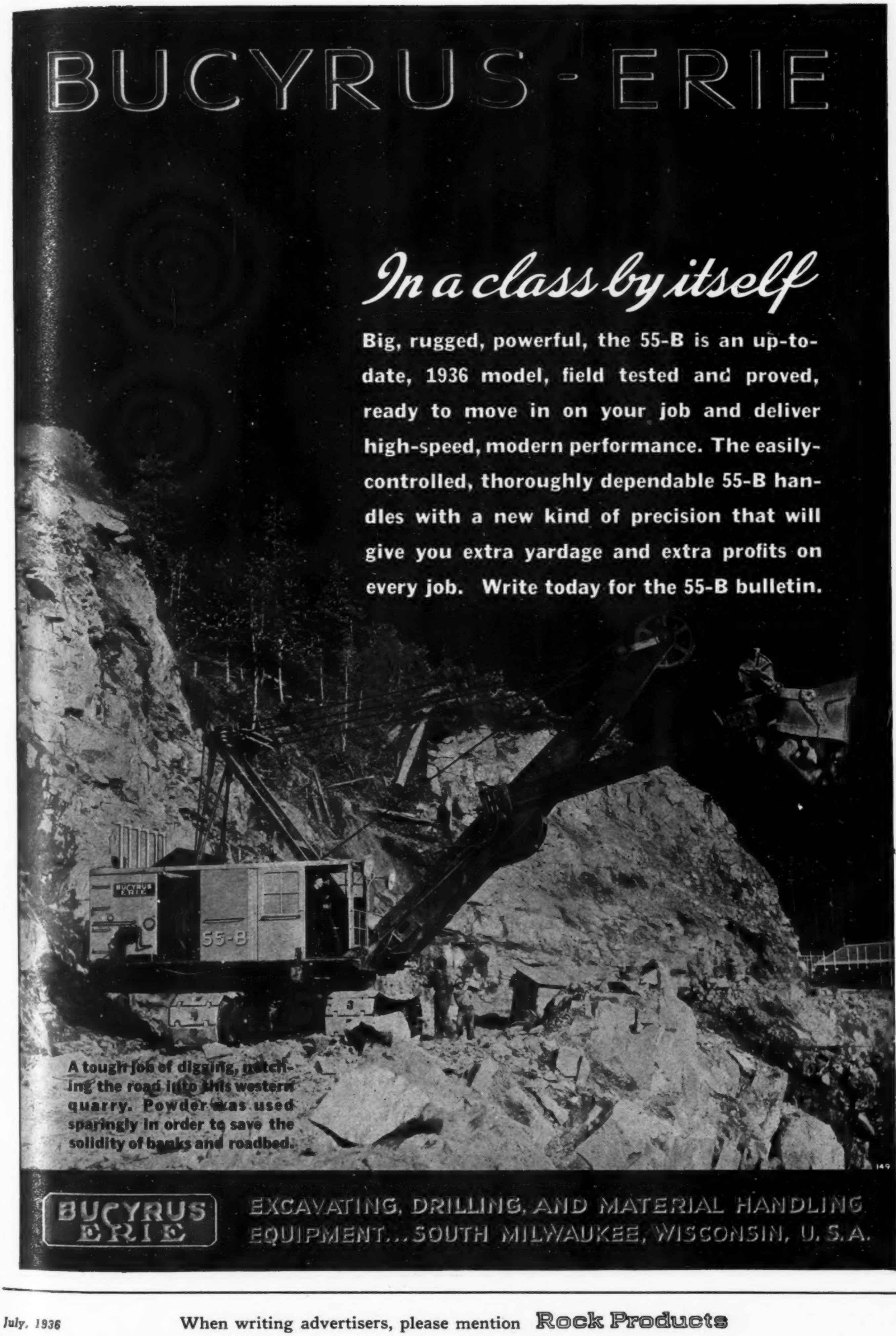
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BUCYRUS ERIE
55-B
A tough job of digging, notching the road into this western quarry. Powder was used sparingly in order to save the solidity of banks and roadbed.
149
BUCYRUS ERIE
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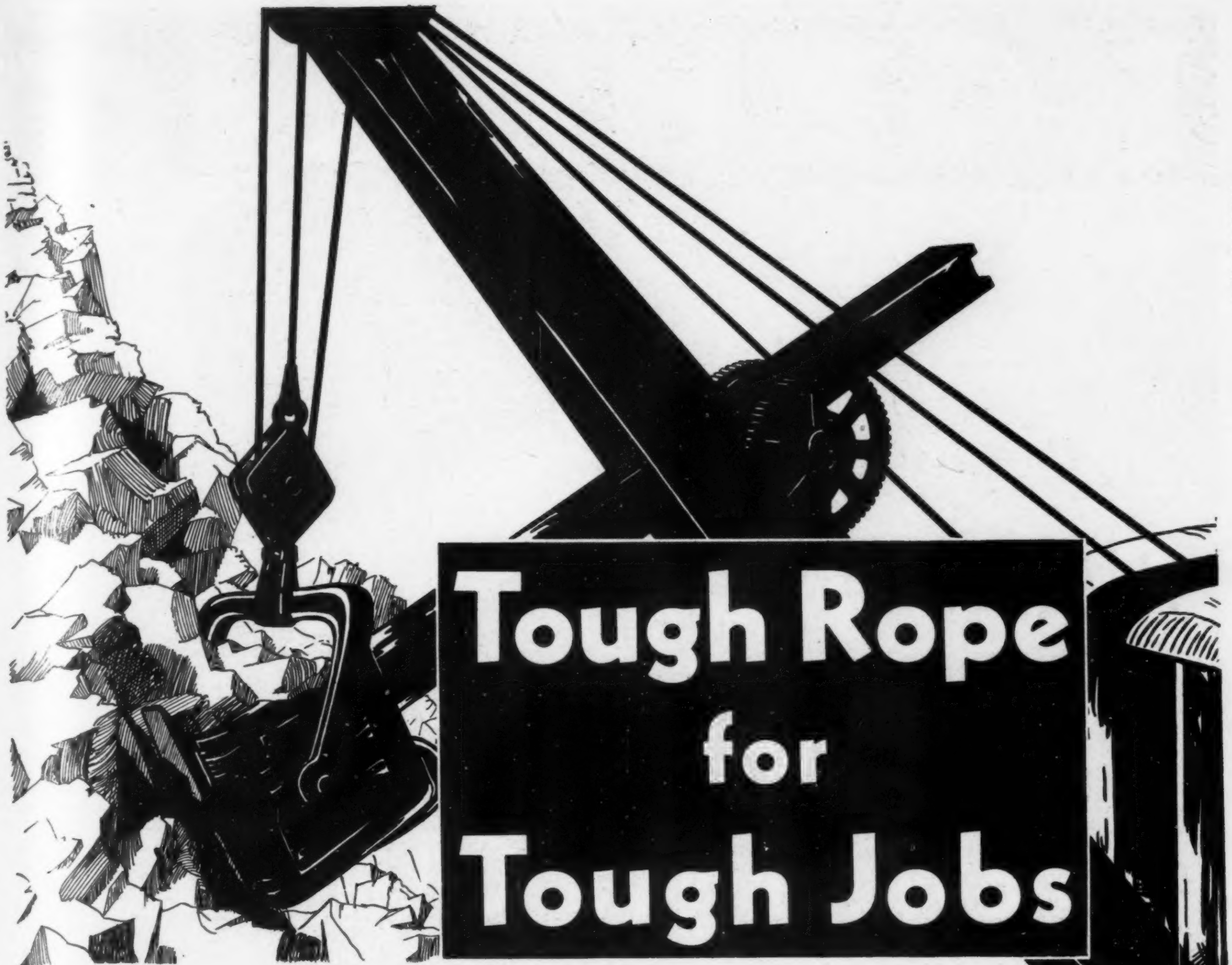

Tough Rope for Tough Jobs

"Flex-Set" Preformed Yellow Strand is especially recommended for hoist line, crowd rope, rack rope and swinging lines on power shovels; for dragline and hoist line on dragline machines; for holding line and closing line on clam shell buckets.

Almost any wire rope will serve well enough in some places—but where the going is rough—*and tough*, there "Flex-Set" Preformed Yellow Strand shows its super-quality—its unquestioned ability to "*take it*," and "*like it*."

This is the same Yellow Strand that has been "taking it" successfully for many years—the same specially drawn wire, tested and selected—the same careful manufacture by the same company that is now *60 years young*.

The difference results from preforming, which sets the strands to the helical form they maintain permanently in the finished rope. Thus "Flex-Set" Preformed Yellow Strand is largely pre-broken in. It is limp—easy to handle and install—highly resistant to kinking, fatigue and wear.

With these properties, how could it be other than economical? Try it!

BRODERICK & BASCOM ROPE CO., St. Louis

Branches: New York, Seattle, Portland, Houston; Factories: St. Louis, Seattle

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"Flex-Set" Preformed YELLOW STRAND

The few cents more per bit that you pay for Timken Bits will bring you additional advantages out of all proportion to the additional cost. The most important of these advantages are:

1. **Timken Electric Furnace Steel, an exclusive material developed especially for Timken Bits by Timken metallurgists and produced in the Timken steel plant under the strictest system of quality control in the steel industry.**
2. **Timken experience in heat treating and hardening. During our 38 years of manufacturing Timken Bearings we have developed methods of heat treatment that enable us to produce results which have made the name "Timken" respected as an authority wherever heat treatment is practiced or discussed.**
3. **Timken design. The Timken streamlined shoulder construction is a strong factor of faster drilling because it permits a uniform distribution of the drill blows on the bit. This feature also extends the life of the bit by protecting the screw threads against strain and injury.**
4. **Uniformity of quality. The precision manufacturing and rigid quality control principles responsible for the uniform quality of Timken Bearings have been applied to the production of Timken Bits with equal success — hence their consistent performance.**

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Some Allis-Chalmers contributions to advanced plant and equipment design.

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Leadership in advocating and building combination grinding mills known as Compeb Mills incorporating:

Grid division heads.

Combination division heads with outside peripheral screens for dry and wet grinding.

Return scoops for delivering material to the mill and grinding circuit at the most advantageous points intermediate to the feed and discharge ends of the mill.

Close circuiting of wet mills and more efficient grinding attained with moisture contents higher than contained in the kiln feed.

Progressive classified grinding system.

Concavex grinding media having high surface contact per unit of weight.

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Advocates of waste heat utilization to generate steam power with waste heat boilers.

Introduction of vacuum filters to reduce slurry moisture content.

Enlargement of kiln diameter in the calcining zone for improved fuel economy and the production of a more completely and uniformly treated clinker.

The recent development now offered to the industry incorporates a chain type slurry dryer unit in combination kilns of moderate length, permitting the extended use of chain as a heat transfer medium to attain fuel economies commensurate with exit gas temperatures below 250° F.

Also as an alternate for existing kilns, introduction of a portion of slurry feed at hot end of slurry drying chains, in unit kiln of moderate length to attain fuel economies commensurate with exit gas temperatures below 250° F.

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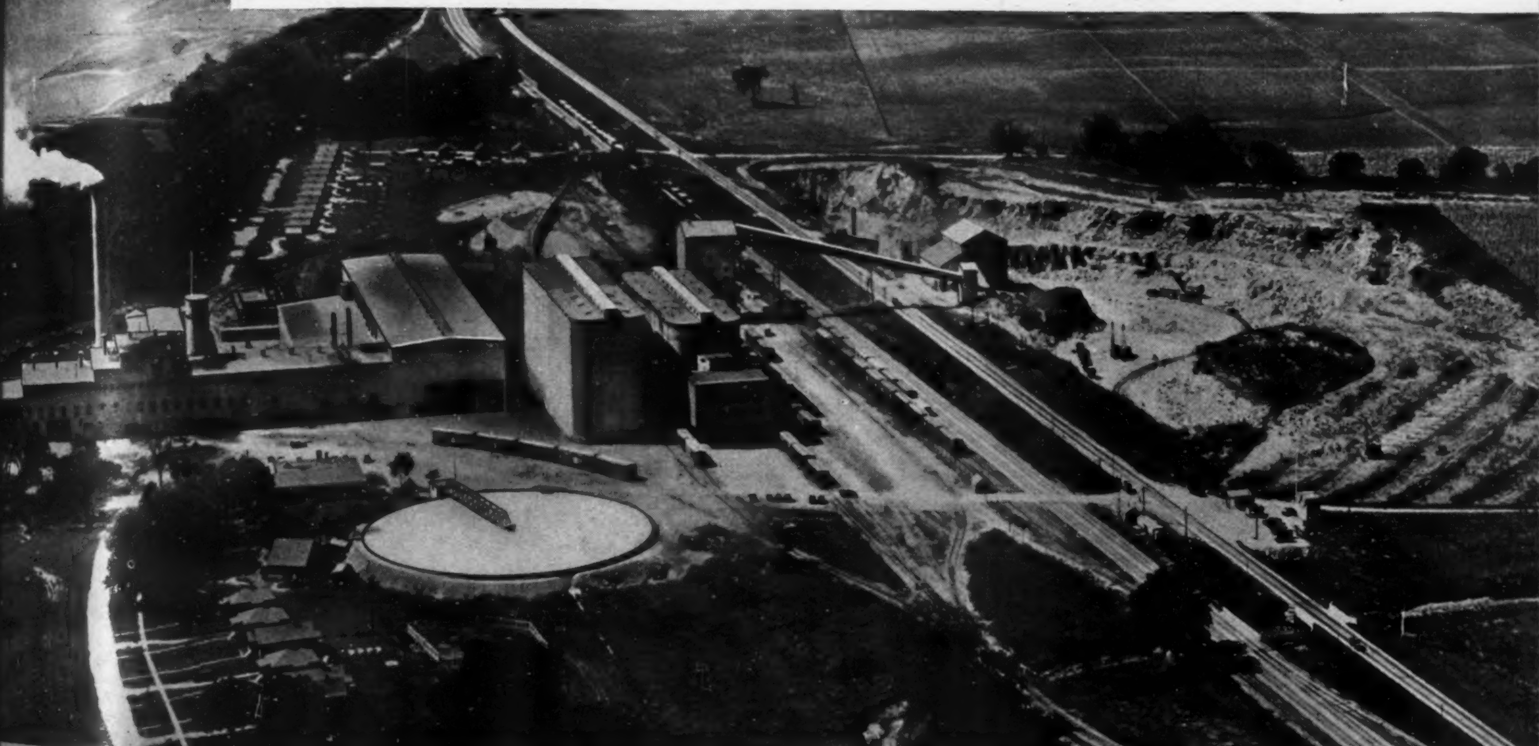
The inspection of Allis-Chalmers Cement Plant Equipment in process of manufacture and in operation can be arranged.



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Designed for

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Hundreds of installations in the field, over a long period of years, have given satisfactory service under every kind of working condition at a minimum cost per ton of material handled, cutting rock, cemented gravel, clay, etc.

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Although we confine our efforts to the actual manufacture of Cutter Head Castings, we are prepared, as a result of many years of experience in the field, to cooperate with users in the selection of designs to fit each particular problem. Send for a copy of Cutter Head Bulletin P. 8 recently issued.

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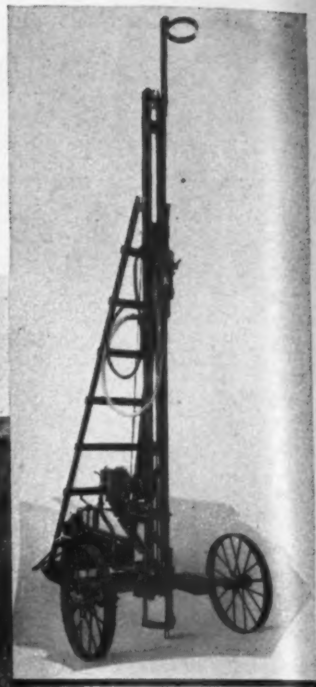
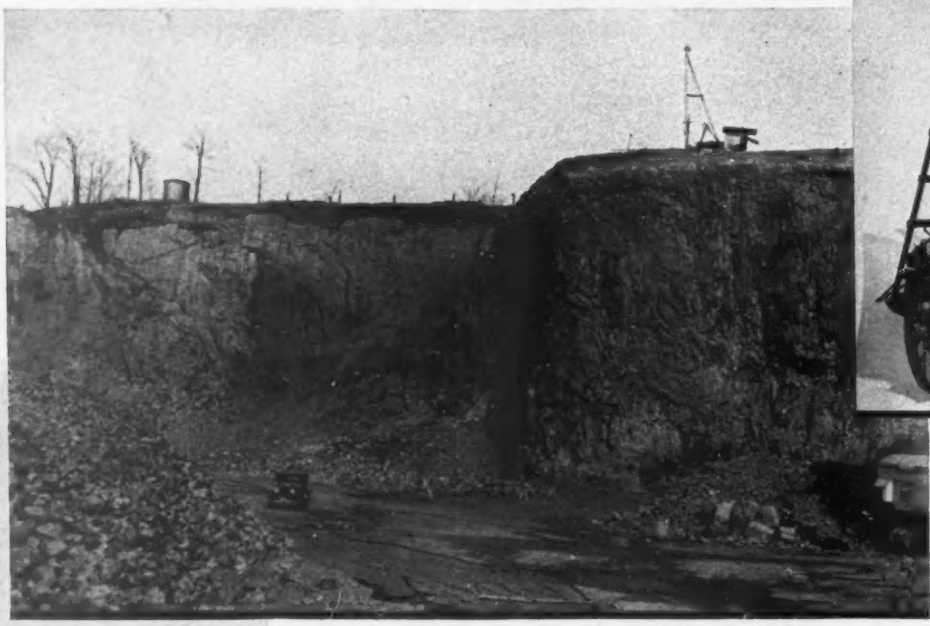
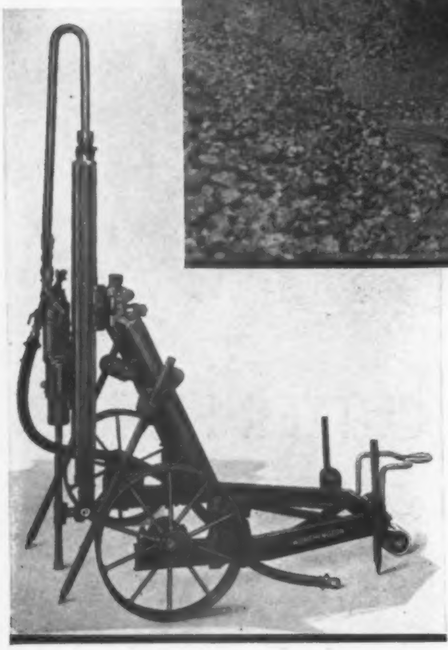


Worthington Wagon Drill . . . a time and labor saving tool of many applications



In this quarry of the Consolidated Stone Company, New Jersey, Worthington Drills are making noteworthy performance records



Worthington Rock Master . . . light, mobile . . . drills at any angle on any type of job

with these WORTHINGTON PNEUMATIC FEED DRILLS

- **Drilling rate increased over 300%**
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Rock Products
With which is Incorporated CEMENT and ENGINEERING NEWS
Founded 1896

Volume XXXIX Chicago, July, 1936 No. 7

What Coöperation Means to An Industry*

TWO WORDS in the English—or American—language are much overworked in industrial and trade literature: one is "coöperation", the other "collectivism". Coöperation is defined as "the act of operating jointly with another or others to the same end; work or endeavor with another or together to promote the same object." So, the first essential to coöperation of any kind is having the same end or object to shoot at.

We think that failure to see a common object has been caused, at least partly, by a lack of frankness by business men with one another. For there certainly is no lack of a common objective amongst any group of business men, whether they are all engaged in one industry or not. Obviously, that objective is to manage their own businesses so these will earn profits.

Coöperation to Earn Profits

The prime objective, the obvious one, but the objective almost never approached directly in associations for industrial coöperation is then: "to earn an individual profit." There are many thousands of volumes of transactions or proceedings of trade association meetings or conventions, and in them all you will find scarcely any discussion on what actually constitutes profitable operation or what the elements of real profit from an industry are comprised of.

If you coöperate to learn to manage your businesses so as to make profits, the nature and kind and amount of profit itself logically ought to be a principal subject of discussion, that the coöperators themselves may all speak the same language and know specifically what they are coöperating for. And we believe this could be done without violating any law.

For example, is there any common understanding as to what constitutes a *fair* profit? That means, naturally, a profit that is fair to the owners of the business, fair to consumers, fair to employes, and fair to society as a whole. It would seem that there can be no general definition of a fair profit. It will vary with the industry and many specific factors, some local, some affecting the whole industry—factors such as the projected life of a business, or industry, the risks of capital involved, the steadiness of the market, the speed of capital turnover, the amount of actual or prospective competition, etc.

Profit has several definitions, but in political economy, or economics, for short, it means "net return left in the hands of a producer after deducting wages, rent, value of materials consumed and fixed capital destroyed". A modern understanding of profit usually includes as a cost item a moderate interest on capital invested, whether this capital is borrowed or belongs to the producer. While profit is customarily computed annually, the real profit can only be measured in terms of the life of the enterprise; or, if one is running a business, as an institution to continue indefinitely, individual profits may be measured by the life times of the principals. Therefore, it would seem that we should approach the problem with some common understanding of a few of these fundamental factors.

Profits spring from a correct pricing policy; yet in no industry at the present time, apparently, is there any uniformity of opinion or common understanding in selecting a base to use in arriving at selling prices. A recent investigation by a market expert of the practice of 200 large business concerns showed five bases had been used: (1) Sales; (2) assumption of risks; (3) costs; (4) investment; (5) conversion of labor costs.

A few of the many questions involved are: Should there be a uniform percentage of profit on all sales, irrespective of the commodity? The government's "cut" on income from industry is frequently taken that way, as in the sales tax. And government, local, state and national, is reported to be getting more from industry than its owners.

Should the margin of profit be reduced as the volume of sales increases? In the case of a whole industry seeking new outlets the answer is probably "yes"; but in the case of an individual producer of a standardized commodity, with cost elements except that dependent on volume much the same for all producers, where the increased volume has been created at the expense of losses in volume by competitors, it would appear hazardous to lower the price because the chances are that such increased volume cannot be held for any great length of time, and the producer who lowers the price will ultimately suffer along with his competitors from this lowered price level.

As to assumption of risks, it is generally recognized that some uses of capital in business are more risky than others, for a great variety of reasons. For example, the constant danger of obsolescence of product or process is very real in some industries. Prices can be based on the long-time risk statistics in the particular industry, just as insurance rates are based. Just how risky is your industry? What makes it risky? What can be done by coöperation to reduce risks?—if you want them reduced.

Should prices be based on costs? This opens up a large field for coöperation because there is a great variety of

*This is an abstract of a paper read to the recent annual convention of the National Lime Association by the editor of ROCK PRODUCTS. The editor apologizes to the members of the lime industry for making it do double duty, but judging from comments received, producers in the other rock products industries will be interested in those parts of it which are applicable to all these industries.

ideas among business men as to what constitute real costs. It is safe to say that very few in any industry fully understand all the factors that affect costs, not merely yearly average costs, but long-time costs, and the extent to which such factors affect costs. Obviously present out-of-pocket production costs do not constitute real costs.

If prices are to be based on a fair return on investment, differences in capital structures possibly must be taken into account. Companies whose actual paid-in capital consisted chiefly or wholly of the proceeds from the sale of bonds, or mortgages, and these have been paid off out of earnings, or are being paid off, are not of the same capital structure as companies whose capital was wholly derived from the sale of common stock or partnerships. In the one case, the profits are realized ultimately in what is in effect the transfer of the plant from the bondholders to the stockholders; in the other case it is the progressive return of the capital of the stockholders, plus increment. Some common understanding of the whole philosophy of business investment is needed before the relation of profit to investment in any one industry can be approached intelligently.

There are advocates for basing prices on a percentage of labor costs, since the efficient management of labor, or personnel, is ordinarily the key to success in any business. But, is this or any of the other fundamental elements which go to make profit and price ever discussed by you coöperatively?

We think not; therefore, is it any wonder that so often we have price wars and unintelligent price-cutting? The old formula of setting a price at "all the traffic will bear" is definitely out of date, probably never to return, for almost every business man today realizes that conditions are such that profits based on this course are short-lived, and the after-effects in new and more competition, not merely between producers in the same industry but between industries, always compensate for large temporary profits.

Of course, there are many who would probably say, off-hand, that a profit is anything you can get over and above costs, and that one producer's profit has no necessary relation to another's. But that is a survival of one form of "rugged individualism" and is not a scientific or professional approach to an industry problem.

It seems that business men have approached their common problem of price and profit from every possible angle *except* the simple, direct and logical one of frankly and honestly discussing openly with one another, in a coöperative group, some of the fundamental principles or philosophy of this problem, and of attempting to arrive at a common understanding. This is essentially an educational activity, but you have within your own group all the educational staff and facilities needed to accomplish results.

Co-öperation for Acquiring a Knowledge of Your Product

To promote the use or increase the consumption of a product is another obvious objective of coöperation, and it is, of course, like all the other possible common objectives merely complementary or supplementary to the primary objective of managing your business for profits. Coöperation to establish and maintain a fountain of such knowledge is essential to any industry worthy to be called an industry. There seems to be no other approach to the acquisition of a comprehensive knowledge of one's product than through coöperation with other producers, coöperation with users of the product, and coöperation with men of scientific learning.

Almost from the birth of science, men who professed a knowledge of science, in other words, professional men, have gathered together in coöperative groups—associations, societies, or institutes—to exchange, with one another, the results of their individual studies and experiences, because they realized that only in this way could they discover the fundamental truths of science; and they knew that there could be no such thing as a monopoly of knowledge. In this intellectual competition they found pleasure and inspiration, and, as a result, science and technology have advanced by leaps and bounds. And it promoted frankness of intercourse.

Members of any coöperative organization may derive at least some of that same kind of intellectual stimulus if they acquire a professional approach to their problems of business management. If they don't acquire a professional attitude toward such problems, their coöperative efforts must in some degree fail, and they are in danger of being out of step with the progress of industry and society as a whole.

Coöperation for Profitable Public Relations

Every business man appreciates the value of goodwill to his own business. It usually has a cash value in the case of a sale of the business. But many apparently have yet to learn the value to them of the public's goodwill toward an industry as a whole. And there is no way to acquire this industry goodwill save through coöperation with that as an objective. Advertising and publicity play their parts, but there are a thousand other ways less conspicuous. Often a great corporation, such, for example, as General Foods, buys a small producer at what seems to us an exorbitant price. But, because of the *goodwill* the General Foods Corporation has built up by advertising, dealer contacts, and other ways, it estimates greater sales possibilities than the lone producer, even of a patented or proprietary article, ever could hope for.

Exactly the same principle applies to a coöperative association which has built up institutional goodwill by similar methods. It increases the sales possibilities of every individual member by having given the product of the industry and the producers in the industry good reputations. Of course, those industry reputations are not built up by the staff of an association alone; every member of the industry coöperates to contribute his share by making and marketing only satisfactory products, by establishing individual reputations for integrity and fair dealing, etc.—in other words, living up to a code of ethics. And here again, only through coöperative effort can the necessary stimulus, or *esprit de corps* of an industry be supplied.

The cultivation of favorable public opinion by industry is obviously more important today than at any time in history, because circumstances and developments have thrown business men and politicians or statesmen into competition to win a favorable public opinion, or at least a public understanding, of many issues which vitally affect the present and future of industry. There can be no doubt of the outcome if business men apply some of the intelligence they use in business to this common objective; they cannot long remain indifferent to what is going on about them; and they cannot pin all their hopes to changes in the breed of politicians. This single objective ought to be

appealing enough to every producer in every industry to convert him to coöperation for the time being, at least.

Those collateral coöperative activities such as accident prevention and product research are recognized now, not merely as aids to efficient management, but as helpful in cultivating the public's goodwill. They are evidences of life and progressiveness that the public as a whole, as well as the customers of the industry, expect of any worthwhile industry. Also, it must not be lost sight of that accident prevention and other evidence of humanitarian treatment of the industry's employes help win *their* goodwill, and their assistance is quite essential in giving the industry a good reputation.

Collectivism vs. Coöperation

Collectivism is defined as "the socialistic theory or principle of centralization of all directive social and industrial power, especially of control of means of production, in the people collectively, or the state: the opposite of indivdualism". A good many of us have been using this word rather loosely, without a clear comprehension of its real import.

The NRA, we think can be seen now, was very definitely a step toward collectivism, although many of us believed at the time it was industrial coöperation with government sanction and encouragement. It probably did do some temporary good by compelling some members of the industry to adopt sane practices; but "a man convinced against his will, is of the same opinion still". There remains the possibility of convincing him by supplying him with greater knowledge rather than by use of police power.

Perhaps our approach to the problem of converting the rugged individualist has been wrong. After all he is a genuine American type. He stands for, or he has convinced himself that he stands for, some of the very fundamentals of American institutions. His stubbornness of belief may outweigh his reason and understanding, but his type is common throughout our history, and often they have been outstanding patriots; often, too, they have been lone wolves and outlaws; depending possibly on their treatment by society.

Probably we must better adapt ourselves in business to the philosophy of human behavior, or psychology, and keep in mind that at least a few of these rugged individualists are essential to a balance in society against being weighed down too heavily by the so-called "Left Wingers". Possibly most of them can be convinced that only through coöperation can the remnants of their individualism be preserved under present conditions. However, probably we shall always have to reckon with some who will be "In-again, out-again Finnegans." These will join up in crises or emergencies, but their concepts of individualism—perhaps entirely justified by circumstances—will be ruffled and they will go out again from time to time. Maybe this will serve to promote the best kind of leadership.

Most of us in business want to continue our traditional and inborn American character of promoting our own and the common welfare by voluntarily coöperating instead of turning to collectivism, that assumes an all-wise state or government, and with which we have never had any experience. That is why coöperative business associations are so important in a nation which has become so preponderantly industrial.

Rugged individualism, while admirable in its time and place, no longer offers a satisfactory solution of our problem, either individual, industrial or national. So it looks as if we have no half-way choice. It is either to be coöperation or collectivism. Probably few of us yet realize what tremendous strides this theory of collectivism has made in winning converts in this country the last few years; and we must not continue to confuse the two terms. They mean opposite things. One is American, the other something else, foreign to all our previous conceptions of American institutions.

Conclusions

Perhaps 50 or 100 years from now professional managers of business will look back upon our generation and give it due praise for the remarkable scientific and technical advances made by it; but they will probably say that it made the conduct of business and industry unnecessarily complicated. The records show, they will say, that our generation was forever complaining about the complexity of economics; that this was not to be wondered at because it appeared that the business men of our time were unacquainted with the fundamental philosophy of business—of such simple relations as prices and profits. They will say that every one had his own ideas, and even where more than one held the same ideas, the practice was so different that we of this generation all appeared to be traveling in individual circles instead of advancing toward a definite objective. These business men of future generations will wonder why brains which accomplished so much in some directions were not more used to develop a philosophy of business and industry which would have made clear to the man of business what he was actually aiming to accomplish, that would have bred a keener perception of the institutional character of business. They will say that these business men of the first half of the 20th century apparently engaged in frequent price wars, which had no other result than the periodic destruction of the money value of the wealth already produced, and that these price wars obviously were caused far more by ignorance of fundamental principles than with malice aforethought.

Summarizing in a few words some of the ideas we have attempted to develop, it is thus: We of this generation have been too close to our individual problems of business and industry to have the perspective to view them as merely a part of the whole problem of human relations, to which business and industry are merely incidental. Consequently, these problems have appeared big and complicated. It remains for us, or those who follow, to develop a philosophy of business. With such a philosophy, while it may not be possible to avoid the rough places, it will at least provide us with the groundwork necessary to approach them more intelligently and help us to solve them by coöperation, or, in other words, to work together for a common end that we all understand; and that such a coöperative business association is a vehicle for providing its members with that perspective, or for broadening their viewpoint. It is a problem of using their own brains and experience in the aggregate through whole-hearted and honest coöperation or depending on some higher intelligence, assumed to be present in state or government, which our experience with political institutions tells us will never be there.

Mississippi LEADS in number of NEW Plants

But Both New and Old Producers Prepare to Cash in On Huge Road-Building Program

By Bror Nordberg,
Associate Editor, Rock Products

Waters and McCrary Gravel Co., Columbus, Miss., moved its plant to increase capacity

THE Father of his Country advised, "In time of peace prepare for war." That's good advice in business. An example of what may occur anywhere with a boom in demand, however short-lived it may be, is exhibited in the sand and gravel industry in the State of Mississippi.

This article does not purport to tell "the all" of developments resulting from the Mississippi highway program, because changes in existing aggregates plants are taking place from day to day and one never knows where the next *new one* will crop up; but we give you an idea of how conditions were late in May of this year.

Probably more sand and gravel plants have been built in Mississippi in the last few years than in any other state, and we suspect that these operations have been built long ahead, in anticipation of the present huge road program, which now exists as a reality.

Several of these plants were described in recent issues of ROCK PRODUCTS.

Sand and gravel production in Mississippi had hitherto been almost at a standstill, with prices as low as 30 to 40c per ton. Quite naturally, with the state's biggest road program in history taking shape, existing operators intend to get their share and improve their plants to enable meeting the demand.

At the same time, out-of-the-state operators are more than a little interested in

View on board the dredge of Myles Sand and Gravel Co., Myles, Miss., showing new 130-hp. Diesel engine

Launching of new all-steel dredge at Hattiesburg, Miss.

Mississippi, with the result that numerous portable and stationary plants are coming in, and operators without previous experience in producing aggregates are going into the sand and gravel business for the first time. For this reason, some of the more conservative producers say: "There will probably be more money lost than will be earned by the time the program is completed."

A total of $42,500,000 will be spent for surfacing state roads, of which $38,000,000 must be spent by July 1, 1937, according to PWA requirements. The 4½ million dollar balance is Federal Aid money, which can be carried a year later. A 1900-mile priority program has been planned. According to officials of the Mississippi Highway Department, just how much of the 1900 miles of paving is to be concrete has not been determined, but the major part is to be first class concrete roadway. It has been estimated conservatively that a minimum of 1400 miles will be completed within the year.

Aggregate in Mississippi has a heavy excess of fines, probably making it necessary to base the rate of usage on the production of coarse aggregate. Preliminary estimates indicate that each mile of concrete road to be built will require approximately 50 cars of coarse aggregate, from 35 to 40 cars of fine aggregate and about 3600 bbl. of portland cement.

Prior to the first contract lettings, all existing plants within the borders of the state, as well as in the Memphis territory, were inspected by state highway officials and the maximum outputs of coarse and fine aggregate, clay binder aggregate and crushed gravel were catalogued for each for a 12- and a 24-hr. day. A study of the tabulations indicated that existing plants with their present equipment would be unable to supply the demand, and that 17 months' maximum production would be necessary to meet the first 13 months' requirement. In other words, the opening of new pits is deemed necessary, and new equipment will go into existing plants. The average project letting is to be for approximately 11 miles, with an even distribution over the state.

Tri-State Gravel Co. is a typical new company, organized to produce sand and gravel at Lexington, Miss. C. T. Cully of Greenville, Miss., and W. A. Delaney of Columbia, Miss., are the officers of the company, which is installing a "Pioneer" plant and dredge. Also, **Kerstens Sand and Gravel Co.** has built a plant near McComb, Miss., to have a capacity of 200 cu. yd. daily, and by the time this issue of Rock Products is published, no

New dredge boat of Myles Sand and Gravel Co., Myles, Miss.

Cars being loaded at new plant of Myles Sand and Gravel Co., Myles, Miss.

doubt other new plants will have been announced.

Practically every producer I contacted admitted that he contemplated radical improvements and additions to his plant, but many remarked that their plans would be held up until they could see just how many "wild-catters" were coming in, and if there would be any price-cutting, before making the needed changes. Others were already making urgent improvements, with the thought of expanding further as the program gains momentum.

Mississippi Sand and Gravel Co., Kolola Springs, Miss., is one of the established companies that is remodeling its entire plant and installing new equipment to increase production. The plant has been changed from a dredge to a dragline operation—a reversal of the usual practice. A 2½-cu. yd. Sauerman "Crescent" bucket and a 30 ft. mast have been installed, to be operated by means of an 80-hp. double-drum hoist manufactured by the American Hoist and Derrick Co. Two 20-in. by 16-ft. Link-Belt screw sand dewaterers and a 4x10-ft. Link-Belt double-deck vibrating screen have been installed. A new 1¼-yd. Lima dragline and clamshell was purchased for stockpiling and stripping. The machine has a 40-ft. boom and is driven by an 88-hp. Caterpillar Diesel engine.

Waters and McCrary Gravel Co., Columbus, Miss., took advantage of the business lull before contract lettings started to install a new 24 by 40-ft. steel hull for its 10-in. Amsco dredge pump operation. The plant was moved to a new location and 1200 ft. of railroad track was laid to the new bins. The old deposit had practically run out and the pumping distance of 1200-ft. was too great. At the new location, pumping will begin at a point 450 ft. from the plant and will work closer to the plant. A new 400-ft. by 2-ft. flume was built. Aggregate will be shipped on the Columbus and Greenville railroad.

Southland Gravel Co., Greenwood, Miss., has been operating for approximately 5 months in the production of pit-run gravel. A 64-ft. deep deposit with 20-ft. of overburden is being worked with a 1¼-yd. Lorain gasoline shovel.

Myles Sand and Gravel Co. started operations in November, 1935, on Bayou Pierre Creek near Myles, Miss. The plant is owned by E. J. Traxler. The location is a fortunate one in that half of the material pumped is "metal." A 130-hp. Caterpillar Diesel engine drives an 8-in. Georgia Iron Works pump by a belt drive. Aggregate is pumped in from 15 to 20 ft. of water to the plant about 300 ft. away. The sizing takes place over a 42-in. by 6-ft. Universal vibrating screen, driven by a 3-hp. LeRoy gasoline engine. The plant has a capacity of 10 to 15 cars daily, which has been the production since the first of the year. Aggregate is loaded from three bins, with a combined capacity of 30 tons, to cars and is shipped on the Illinois Central Railroad. The company has started to build another plant with an 8-in. pump driven by a Caterpillar 160-hp. Diesel, at Utica, Miss.

Lynn Gravel Co., Avalon, Miss., was installing a belt conveyor, 108-ft. centers, equipped with Jeffrey idlers, to serve as a field conveyor for removing overburden. **Green Bros.,** at Lexington, Miss., have relocated their plant on Little Black Creek and improved it to increase production. Production is so arranged that, in spite of a great preponderance of fines, approximately the correct proportions of sand and gravel for concrete are produced. This firm is building up a huge stockpile in preparation for expected road contracts.

At Hattiesburg, Miss., **Forrest County Gravel Co.** had just launched a new 30x 40-ft. all-steel hull to be equipped with a 10-in. Diamond dredge pump to be used for relaying material to the present 10-in. dredge. **American Sand and Gravel Co.** was building a new steel dredge boat and had already installed a 3x10-ft. Tyler vibrating screen.

Other plants, besides the few mentioned, are repairing and modernizing, and it looks as if by the time the program gets into full swing, the available supply of sand and gravel will be very much more than sufficient to meet the requirements predicted by the state highway engineers.

Projected Plant

Hargil Co., Cassville, Wis., is reported to be planning to establish a sand and gravel plant in La Crosse, Wis., on a deposit leased by Martin R. MacDonald. It is reported that Mr. MacDonald will handle the sale of the products produced.

Tax Exempt

Canadian producers of crushed stone, sand and gravel will be exempt from sales tax for material sold for provincial, county or township roads under the Dominion budget for the current fiscal year.

Shovel excavating crude aggregate at Southland Sand and Gravel Co. pit, Greenwood, Miss.

Outlook Bright

United States Gypsum Co.'s (Chicago, Ill.) president, Sewell L. Avery, is quoted in part as follows:

"Until waste and the accompanying threat of inflation are removed, the great volume of idle funds now existing cannot be released and really put to work.

"There is a general push back toward prosperity from accumulated economic needs alone, but its inevitable coming is being greatly delayed.

"The accumulated needs are such that they are coming in with such increased force as to forecast a great shortage in skilled talent which in turn means much higher wages and salaries until the shortage is met.

"Available funds can purchase new equipment and material to great economic advantage because of improvements effected over the past several years.

"Furthermore the surplus capacity which we have been assuming to be ready to take care of better business does not exist to the extent generally believed. The truth is that whether the field be railroads, housing or other lines the actual surplus percentages are less than those reported and accepted.

"Much of the surplus is not in good condition. The best equipment has been used during the depression as a matter of economy. Lack of repair and maintenance has run down the condition of the rest.

"Actual and prospective shortage applies not only to equipment but to managers and skilled labor and with the freeing of business from expansion-restricting fears it would apply to actual manual labor also."

Expands to World Markets

F. E. Schundler and Co., Inc., which operates mineral processing plants at Joliet, Ill., and Long Island City, N. Y., has now completed its arrangements for the sale of Schundler processed expanded vermiculite in the British Empire and on the continent of Europe.

An English company has been formed in London known as British Vermiculite Products, Ltd., operating a Vermiculite expanding plant in Stratford.

More Sugar Stone

Ingleside Limerock Co., Guernsey, Wyo., a subsidiary of the Great Western Sugar Co., resumed production June 1. J. W. Dudgeon is general superintendent. Production will be larger than last year, he said.

Reopen After Five Years

Waushara Granite Quarries Co., Red Granite, Wis., resumed operation June 15, after five years' shut down. The principal product is paving block, but crushed stone is also produced.

Big Rip-Rap Job

Fort Peck, Mont.: U. S. Engineers will ask for bids, to be opened July 7, for rip-rap stone delivered f.o.b. Wiota. Three classes of stone are listed in the specifications. Class A stone is 3 to 7 tons in size for each piece, with an estimated quantity of 229,000 cu. yd. Class B stone is 1 to 5 tons in size with an estimated quantity of 308,000 cu. yd. Class S stone (spalls) weighs 25 to 150 pounds each, quantity 228,000 cu. yd. The total quantity involved is about 765,000 cu. yd. The quantities given above are for Type Y stone weighing 4455 to 4725 lb. per cu. yd. If the stone is lighter or heavier than the limits indicated, a greater or less yardage will be required.

Installs Dust Collectors

Bessemer Limestone and Cement Co., Bessemer, Penn., is installing a Norblo dust-collecting system in the finish grinding mill.

Research Planned

Feldspar producers in the Spruce Pine district, North Carolina, according to local report, are feeling the competition of South Dakota and Colorado producers. Such competition is likely to persist under present producing and market setups.

Offsetting this threat to local feldspar mining and grinding are the possibilities of very great changes in the processing of the local feldspars to the end that a finished product may be produced to sell below the present market prices. Some of the grinders have for some years been working to that end. Lately the U. S. Bureau of Mines and the Ceramic Research Division of the Tennessee Valley Authority have been giving much attention to the problem of how to process the lower-grade local feldspars to the end that they may be used to make a high grade finished product.

Plans are understood to be under consideration for a coöperative project under which the Bureau of Mines, the TVA and all feldspar grinders in this district or using crude feldspar from this section would undertake jointly to work out methods which would remove the impurities from the very extensive local low-grade deposits.

Some tests along entirely new lines of processing indicate very great possibilities in reducing the cost of processing. If these prove practical on a commercial scale, they would mean that the low-grade deposits could be worked by power excavators.

Adds Equipment

Campbell Limestone Co., Gaffney, S. C., has purchased and moved by motor truck some of the equipment used in the construction of the Holland tunnel under the Hudson River at New York City.

Rock Wool Made in Electric Furnaces

Spun Rock Wools, Ltd., Thorold, Ont., Canada, for the past two years has been making rock wool from local limestone by a process it has developed.

The limestone is melted in electric arc tilting furnaces. The furnaces are tapped and fed continuously. The molten slag carries the current between the electrodes. When the rock is melted and at the proper temperature it is poured and spun centrifugally to produce the wool. This wool is drawn away as fast as made and is carried to collecting chambers where it is bagged for shipment. Packed tightly in bags, "Spun" rock wool has a density of about 6 lb. per cu. ft.

Spun rock wool, as made by this process, is long-fibered, light in color, tough, resilient and almost free of "shot." Tests by the Dominion Department of Mines, Ottawa, show no loss in volume after very severe and long-continued shock tests. The fibers have been shown to have an unusual resiliency and strength so that repeated compression does not break them and the mat of fibers retains its full insulating value.

When the Spun rock wool is taken from the bag used for shipment, it expands to about double the volume, namely from 6 lb. per cu. ft. to 3 lb. per cu. ft., at which density it is used for the insulation of dwellings. Spun rock wool can be applied at any desired thickness for industrial work such as hot water tanks, stoves, etc.; it is usually used at the bag density of 6 lb. per cu. ft.

Wins Safety Competition

Certain-teed Products Corp.'s gypsum mine, Akron, N. Y., won first place in the nonmetallic group in the U. S. Bureau of Mines' 1935 safety competition. It was operated through 79,144 man-hours without a lost-time accident. It will receive the *Explosives Engineer* trophy "Sentinels of Safety."

Changes From Steam to Diesel

Kivett and Reel, Inc., Sun, La., sand and gravel producers, recently replaced their steam-power electric generating plant with a 262½-hp. Buckeye Diesel engine unit, which includes a Westinghouse 15-kw. d.-c. excitor and an Ideal 175-kw. a.-c. generator. A 4-in. Fairbanks-Morse centrifugal pump was installed to supply wash water

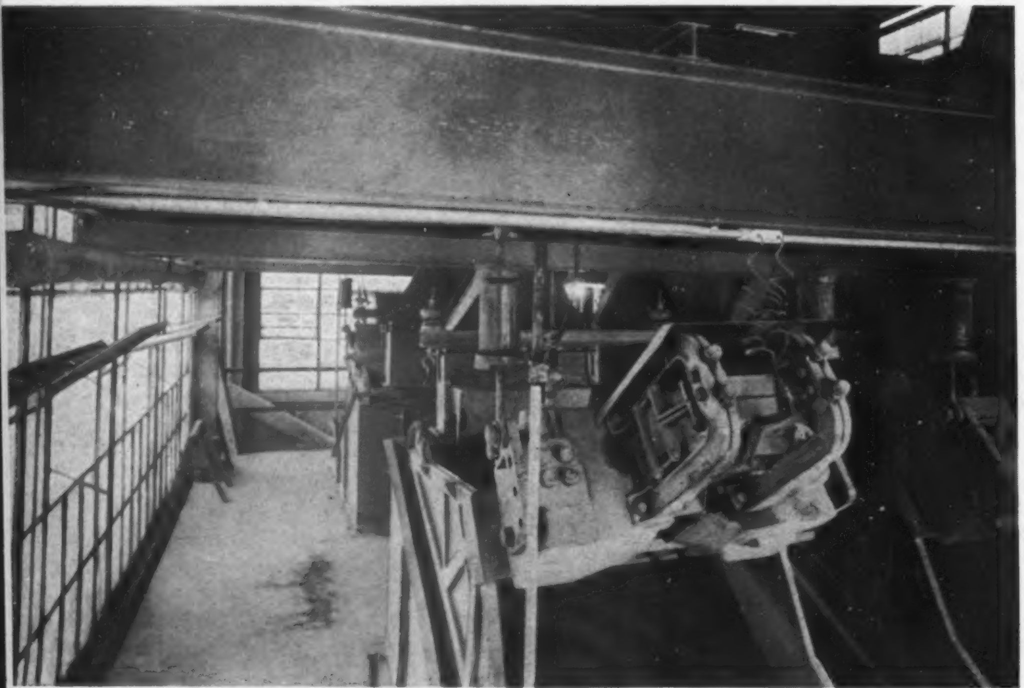
Expands

Pacific Portland Cement Co., San Francisco, Calif., is reported to have acquired by purchase from the reorganized Ross Island Sand and Gravel Co., for $175,000, the controlling interest in the **Beaver Portland Cement Co.,** with plant at Gold Hill, Ore.

Other effective changes, too. Pennsylvania-Dixie Cement Corporation Makes Improvements in Both Raw and Finish Mill Hook-Up at Richard City, Tennessee, Plant.

RAW MILL

OUTPUT NOW UP 40%



New screens for slurry at Pennsylvania-Dixie Cement Corp. plant

THE REPLACEMENT of two centrifugal slurry separators with four Jeffrey-Traylor electrically vibrated screens has raised the Kominuter output 35 to 40%, at the Richard City, Tenn., plant of the Pennsylvania-Dixie Cement Corp. Two 4 ft. x 7 ft. screens, equipped with 0.045-in. "Tyrod" cloth, are operated in closed circuit with each No. 106 Kominuter. The material as fed to the screens contains 30% water, the screen fines 35% and the tailings 12% water. The 16-mesh fineness has been raised from 95.8 to 98.2%. This increase in fineness has in turn permitted a small increase in the output of the three 7 ft. x 27 ft. tube mills.

Air Separation

Two 16-ft. Bradley air separators were installed in the clinker mill in order to improve uniformity of product and to increase the capacity when making Type B cement for the Tennessee Valley Authority.

Preliminary grinding is accomplished with eighteen 30-in. improved Griffin mills, which are followed by three No. 18 Smidth tube mills, 6 ft. 6 in. in diameter and 18 ft. 0 in. long.

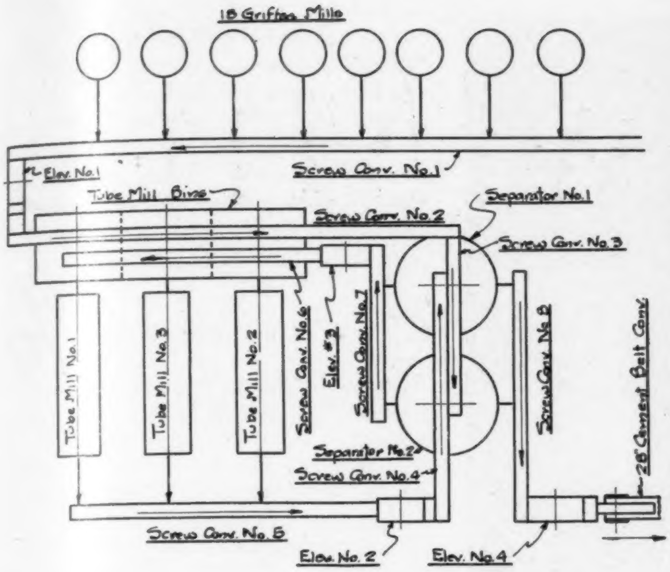
The essential features of the installation are shown on the sketch. Space limitations made it necessary to make this installation rather compact, but all equipment is accessible for inspection and repair. It was found necessary to raise the roof about 20 ft. over the separators and elevators.

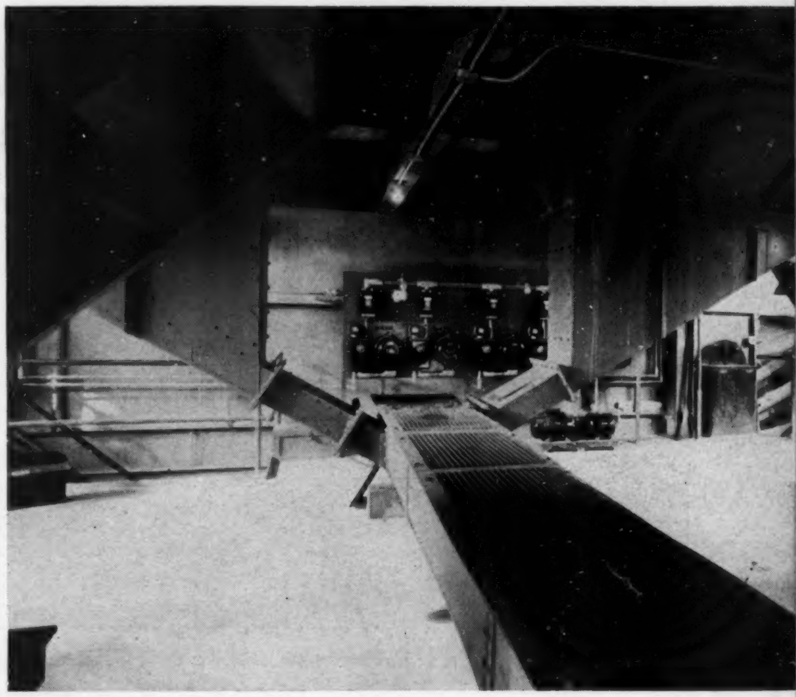
Each separator is driven by a 75-hp. General-Electric motor through a Morse silent chain drive. Three additional elevators and seven short screw conveyors comprise the accessory equipment. The conveyors and elevators are driven by 5- and 10-hp. motors and Philadelphia worm reducers, and where possible the conveyor drives are grouped, one drive unit taking care of two screw conveyors. The motor controls are grouped in the end bay of the building, which is separated from the main grinding room with a solid partition. The 250-hp. tube mill motors are also located in this room. Cross-the-line starting is used for all motors including the 75-hp. separator drives. Push buttons are provided at each motor and at the starter location. The separators accelerate to full speed in about four seconds.

Flexibility

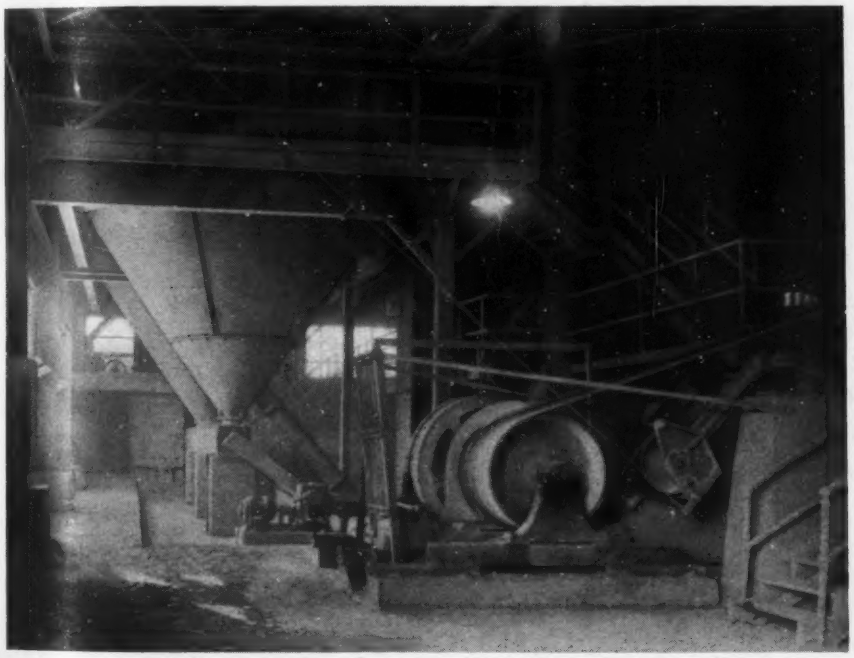
Various hook-ups are possible under the new arrangement, permitting a very flexible

Close-up of two screens for slurry in Richard City, Tenn., installation





***ABOVE:* Diagram of compact arrangement of air separators and clinker mills for fine grinding of finished cement. *RIGHT:* Discharge hoppers from screens to screw conveyor; panel board in background**



***ABOVE:* Two new air separators, with screw conveyor below. Note pipe for tailings. *RIGHT:* New panel board for controlling motors which drive elevators and screws to the mills. *BELOW:* Motors which operate the separators. Screws for conveying fines are also visible**

operation. Ground clinker coming from the Griffin mills has a 200-mesh fineness of 65%. A typical operation is as follows, (see sketch): Griffin mill product passes by No. 1 screw conveyor to No. 1 elevator. The elevator discharges to the No. 2 screw which can discharge either to the tube-mill feed bins or to the separators. The tube mill product discharges to the No. 5 screw conveyor to the No. 2 elevator to the No. 4 screw conveyor to the separators' feed.

Tailings from both separators pass to the No. 3 elevator by way of the No. 7 screw and are discharged to the tube-mill feed bins. Fines from the separator discharge to the No. 8 screw and pass by way of the No. 4 elevator to the finished cement belt conveyor. No. 7 screw, No. 3 elevator and No. 6 screw to the tube mill feed bins always handle tailings.

Thus far three different hook-ups have been tried which may be designated as "A," "B" and "C." In hook-up "A," both the Griffin mill and tube mill discharges go to

Elevator heads on floor above screens

the separators through separate conveyors, each stream being divided equally between the separators. Tailings from both separators comprise the tube mill feed.

In hook-up "B," the Griffin mill product goes to the tube mills which are operated in closed circuit with the separators. In this hook-up the tailings may be divided between the three tube mills and combined with the Griffin mill stream or the tailings may be tube-milled separately from the Griffin mill product.

Hook-up "C" is similar to "A." In this case, however, the entire Griffin mill product goes to one separator and the entire tube mill product goes to the second separator. In scheme "A," each stream is divided equally between the two separators. In both cases, the tails are combined to form the tube mill feed. Other combinations are possible, but up to the present, only the hook-ups described above have been tried.

Mine Development

Santa Cruz Portland Cement Co., Davenport, Calif., has begun a new 9- x 12-ft. drift in its limestone mine, which will extend 800 ft. On its completion two raises to the surface, about 200 ft. above, will be made, and the stone removed by the glory-hole system of mining. Two such drifts are already in use.

Modernizing

California Portland Cement Co., Colton, Calif., is adding new equipment and facilities, including new storage silos and packing plant. The Fuller-Kinyon system of cement pumping is being installed.

New Equipment

Signal Mountain Portland Cement Co., Chattanooga, Tenn., has recently completed plant improvements costing $48,000, including a B & W unit coal pulverizer for firing one of the kilns.

Business Much Better

Medusa Portland Cement Co., Dixon, Ill., plant is reported locally to have between 30 and 40% more business than in 1935. Much of it is coming from small town dealers.

Resumes Production

North American Cement Corp., Alsen, N. Y., plant resumed production June 1, after being shut down from January 1.

New Director

Universal Atlas Cement Co., Chicago, Ill., announces the election of Oscar N. Lindahl as a director. The other four directors are William A. Irvin, president of the United States Steel Corp., B. F. Affleck, president of Universal Atlas, K. K. Knapp, attorney, and J. H. Kempster, superintendent of the company's plant at Buffington, Ind. Mr. Lindahl is auditor and assistant secretary of the cement company, auditor and director of the Atlas Lumnite Cement Co., and auditor of the Atlas Gypsum Corp., all Corporation subsidiaries. He has been connected with the Steel corporation for nearly thirty years, being with the Illinois Steel Co. four years and with Universal Atlas since 1911.

Improvements

Lone Star Cement Co., Pennsylvania, Nazareth, Penn., subsidiary of the International Cement Corp., New York City, is making extensions and improvements to cost $75,000.

Stack Contract

Marquette Cement Manufacturing Co., Chicago, Ill., let the contract for the 350-ft. reinforced-concrete stack at its Cape Girardeau, Mo., plant to the Alphonse Custodis Chimney Co., Chicago.

May Statistics

THE portland cement industry in May, 1936, produced 10,985,000 bbl., shipped 11,121,000, and had in stock at the end of the month 20,435,000. Production and shipments showed increases of 33.6 and 49.7%, respectively, as compared with May, 1935. Stocks at mills were 7.1% lower than a year ago.

The statistics here given are compiled from reports for May, received by the Bureau of Mines, from all plants except one.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 162 plants at the close of May, 1935 and of 160 plants at the close of May, 1936.

RATIO (PERCENT) OF PRODUCTION TO CAPACITY

	May 1935	May 1936	April 1936	Mar. 1936	Feb. 1936
The month	36.1	48.9	39.2	23.4	16.4
The 12 months ended	27.7	31.6	30.5	29.6	29.2

Irish Cement Industry

Irish Free State government is soon to build two large cement plants at Drogheda, and Limerick, to supply the home market which uses up about 300,000 tons of cement imported annually from foreign sources. For the establishment of the industry, Cement Limited, has been formed as a company with a capital of £300,000 ordinary shares, and a loan capital of £450,000 first mortgage debenture stock.

N. M. Jensen, deputy chairman and managing director of the Tunnel Portland Cement Co., Ltd., London, one of England's largest cement companies, is to be chairman of the new company. Other members of the board are Sir John Keane; C. M. O'Kelly, managing director of T. and C. Martin, Ltd., Dublin; H. A. V. Osterberg, Dublin, first vice-president of the National Portland Cement Co., Inc., Philadelphia, Penn., who is managing director, and M. F. Parkhill, managing director of Charles Tennant and Co. (I. F. S.), Ltd., leading Irish business men. Machinery has been purchased.

Installing Dust Collectors

Huron Portland Cement Co., Detroit, Mich., is reported to be installing a Norblo dust-collecting system in its Cleveland, Ohio, packing plant.

Portland Cement Pavement Yardage

AWARDS of concrete pavement for May, 1936, were announced by the Portland Cement Association as follows:

	Sq. yd. awarded during May, 1936	Total sq. yd. for year to date, May 30, 1936
Roads	3,621,176	10,579,750
Streets	1,571,899	5,344,675
Alleys	42,202	126,105
	5,235,277	16,050,530

Busy Session in Prospect

National Sand and Gravel Association, Washington, D. C., will consider many interesting and vitally important subjects at its board meeting in St. Paul, Minn., July 9 and 10. Here are some of the things on the agenda:

(1) Federal legislation affecting the sand and gravel industry.

(*a*) The Walsh-Healey Government Contracts Bill.

(*b*) The Patman-Robinson Price Control Bill.

(*c*) Taxes levied on employers, and responsibilities imposed on employers, by the Social Security Bill.

(*d*) The Federal Tax Bill.

(*e*) The regular Federal-aid Highway Bill.

(*f*) Continuation of WPA projects.

(*g*) Continuation of PWA projects.

(*h*) Industrial regulation by the Federal Government.

(2) Inclusion of occupational diseases such as silicosis under state compensation insurance laws.

(3) Interest of sand and gravel industry in struggle between horizontal and vertical unions for organization of employes in industries not now organized.

(4) Prospective sand and gravel market in 1936 and 1937, and effect on industry of governmental competition.

(5) Stabilization of state highway programs through adequate planning; diversion of highway tax funds.

(6) Extent of revival of private construction market and its influence on sand and gravel demand.

(7) Report on Association finances, and outline of program for securing additional memberships.

(8) Consideration of proposal for reinstating the *National Sand and Gravel Bulletin* in printed form.

(9) Needed research work in the sand and gravel industry, and possible effects of failure to plan and administer an adequate research program.

Traveling stacking conveyor built for Moulding-Brownell Corp.

(*a*) Use of sand and gravel in bituminous mixtures.

(*b*) Aggregates for fireproof construction.

(*c*) Deleterious substances and soundness tests of aggregates.

(*d*) Recent revisions in national specifications for aggregates.

(10) Selection of place and date of next annual convention of the Association, including determination as to whether the convention should be held earlier than customary in the past.

Movable Stacker Cuts Stripping Cost

THE accompanying illustrations show the traveling stacking conveyor built for the Moulding-Brownell Corp.'s gravel plant at Cayuga, Ind., by the Stephens-Adamson Manufacturing Co., Aurora, Ill. This movable conveyor unit replaces the usual dump car trains, and since its installation has shown an average annual saving of approximately $6000, according to its manufacturer.

As shown, the stacker is moved parallel to the bank, just ahead of the gravel loading operation. Overburden stripped from the deposit is carried out over the loading track and discharged on the pit floor—out of the way of any future operation. Thus stripping is simplified to one handling process, and the capacity has been increased by the elimination of intermittent car service.

One of the views shows the row after row of piles on the floor of the pit—deposited as the stacker has been moved back and forth across the face of the deposit.

The stacker is a self-contained unit consisting of a loading hopper, belt feeder, and a 24-in. by 112-ft. belt conveyor, mounted on two pivoted trucks. The outer end of the conveyor is supported upon a steel frame, which in this case permits working faces of 40 ft. or greater depth. Both feeder and conveyor are equipped with Pacific type belt carriers, in which each roller turns upon double Timken roller bearings. This conveyor is exposed to the elements the year round, but the bearing protection is sufficient to prevent damage by moisture, dirt and gravel.

Movable stacker deposits overburden in piles on floor of pit at Cayuga, Ind.

To Be Sold

Pioneer Sand and Gravel Co., Ltd., Victoria, B.C., with plant at Royal Bay, has been ordered sold by the provincial supreme court to satisfy creditors.

Beg Your Pardon!

The photograph of A. Warsaw, which was reproduced on page 49 of the June, 1936, issue of ROCK PRODUCTS, was one taken by Blank & Stoller, New York, N. Y. Credit line was inadvertently omitted.

How to Prepare CONCRETE Aggregates that please customers

By Stanley M. Hands, C. E.,
San Francisco Bay Bridge Unit, Materials and Research Department, Division of Highways, State of California

Above: (7) A cause for no profits—a concrete which crushed at the bottom where the composition is poorly consolidated coarse aggregate and excess water

THE OWNER of one of the largest and best plants in California asked the writer what could be done to make his aggregate business profitable. The inference is quite complimentary. He hopes to get numerous opinions from those who are directing the use of such products.

The best reply to such a question is to make the best product and sell it at the lowest possible price. This answer suggested to him that the best product should be defined as something better than that required by a specification, but he was doubtful that something better is preferred by the ordinary buyer.

Generally, this may be the case, but there are frequently in every locality some demonstrations to show the possibilities of a good material. If not, a producer could arrange such a demonstration and prove the relative value of his product.

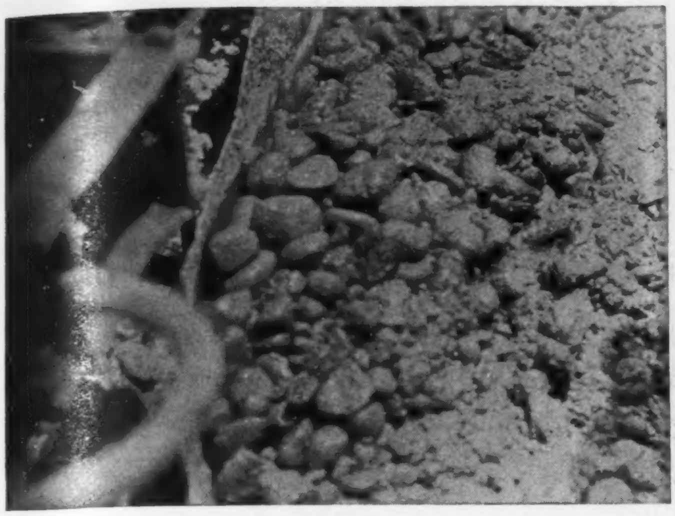
Meeting a "State specification" is not an endorsement of a material except to an engineer who knows State methods and the reasons for the form of the specification. Usually State specifications recognize no premium. They are made to cover the use of average materials. It would be almost impossible for any political subdivision authority to make standards not attainable under prevailing conditions. Therefore, such specifications are usually rather general, and the more detailed requirements are covered by standard practices that are developed in the field. These are the details that dominate the aggregate industry, and if they are not discriminatory and favorable to a better price for a better product, it means one or two things: either the material is not any better, or the average expectancy of performance is not great.

Measures of Quality

Standards of performance are numerous. High average strength in concrete is not a difficult attainment. To get uniform strength, uniform volume changes, uniform density, and all of these measured by high standards, is quite another thing. These require skill. This kind of concrete will become a com-

Below: (1) A mixture containing a minimum amount of surplus mortar

Below: (2) A mixture segregating because of surplus of small coarse aggregate



(3) Mixture in which segregation due to particles interference has not been overcome by finishing machine

(4) Big rock which was specified for use "in pavement" has accumulated in one place in this mixture

mon standard. Therefore, the common denominator of the common factors of processing aggregates and cement, of designing and controlling the mixture, of methods and tools for fabrication, is or will be skill. And, even so, since concrete is a construction material that is competitive with other materials, these standards must be attained economically. Good aggregate may be defined according to variable conditions. The tendency toward special provisions, instead of fixed standards, is evidence of this.

The manufacture of concrete of uniform desirable properties imposes recognition and control of numerous factors. The significance of these factors is conditional and therefore cannot be more than generally implied in specifications. Most producers sell to markets that are dominated by precedents rather than advanced application. If the measure of attainment is strength of test specimens, fulfillment is relatively simple. However, there are other equally desirable properties of concrete, and these are often neglected.

(8) A harsh mixture is hard to keep distributed evenly in front of the finishing screed

Aggregate Producer as a Factor

The aggregate producer's customer, usually a contractor, contracts to make concrete which conforms to certain strength requirements. The producer has no effective control over this because grading is not a fundamental strength factor. The producer can, however, fix the cost of cement because grading is a factor in cement economy. Likewise, he can influence the methods of manufacture and therefore the cost of concrete because grading affects workability.

Below: (5) Accumulated large rock necessitates undesirable shoveling on job. (6) The strength of the finished product thus prepared is greatly diminished

Abrams stated that *"for given materials and conditions of fabrication* the strength and therefore other desirable properties of concrete depend upon the water-cement ratio." This has been confirmed by numerous investigators. It must be recognized that this statement insists upon "given materials and conditions of fabrication." If several sets of aggregates and cements are tested, there results from these a series of parallel results. Thus one combination of cement and aggregates may, *when tested at a given age,* give relatively higher or lower results than another set when tested at that age. However, at some other age of test, the strength ratios of the two sets may be greatly changed. Pick your own standard of strength.

(11) Concrete seal after dewatering of cofferdam

The aggregates industry can do little to change cement properties. Most of the cements now on the market, regardless of the great differences they exhibit, are needed to meet the many problems that arise because of the broader general properties of portland cement concrete. It is not unlikely that more types of cement will be developed in the future. The cement-physics problem is very much different from the aggregates problem.

Why Aggregates Are Processed

The principal reason for processing aggregates is to group sizes in order that batching operations will give a mixture of very definite size composition. This size composition or combined grading is desirable to control the extent of operation of the physical properties of the water-cement paste. It is this paste that determines the desirable properties of the concrete mixture. These desirable properties are the correct mass action in the plastic and solid concrete.

These desirable properties of wet and dry concrete are the common denominator of all operations of washing, sizing, proportioning, mixing, fabricating and curing concrete. All of these complications were avoided by Abrams when he stated that "for a given material and conditions of fabrication the strength and other desirable properties of concrete depend upon the w/c."

(9) Equipment used in handling underwater concrete

A producer's problem in securing a premium for his product arises from two main factors. The first of these, because it has its origin in the design of a pavement or structure, is economy of cement. A concrete which meets strength requirements with the least amount of cement is desirable providing there is a uniform distribution of cement throughout the mass or structural element. The second factor is the correct plastic mechanics of the mixture. This is generally expressed in workability, and is the essence of the water-cement law. However, the operation of this basic law is dependent upon the concrete being plastic at the instant of fabrication. Failure to recognize this basic condition explains the failure to define good aggregates and to sell them at a premium.

Workable Concrete Mixtures

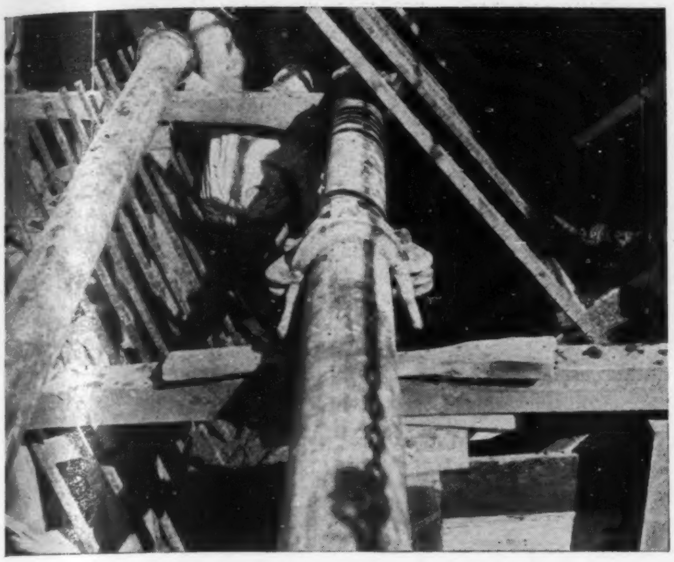
The subject of making concrete mixtures that are equally plastic at the instant of fabrication is another subject, but the differences in so-called workable concrete may be illustrated. The pictures accompanying this article bring out the point that plastic concrete as defined as essential to Abrams' law is much different from workable concrete as often conceived in the field.

Photographic illustrations Nos. 1 to 8 indicate the theme of one-half of the cause for little or no profits in the aggregate business. The measure of quality for this project is (1) conformation with a prevailing method of designing a concrete mixture; (2) high compressive strengths for test specimens; and (3) a finished surface which "straight edges" to certain limits at the time of fabrication. Compliance with these standards has been attained.

No. 1 indicates a mixture containing a minimum amount of surplus mortar, probably due to an increase in void space in the coarse aggregates because of a surplus of small coarse aggregates. No. 2 indicates a form of segregation due to an excessive amount of particle interference by this surplus of small coarse aggregate. No. 3 confirms No. 2 in that the finishing machine cannot overcome the interference and dispose of the large aggregates in the mixture. No. 4 shows the accumulation of big rock which the specifications required for use "in pavements." In order that this material shall be "in" the pavement, a method is developed in the field—No. 5. The large rock is shovelled on to the subgrade to make pavements having an effective depth like No. 6, the strength of which is reflected by the specimen, No. 7, which crushed at the bottom where the composition is poorly consolidated coarse aggregate and excess water. Since there is a difference in the water-cement ratio and cement per unit volume in the concrete at the top and bottom of the pavement, the surface became deformed by unequal shrinkage and volume changes due to absorption of water from the subgrade.

Actually, none of the desirable qualities anticipated by the method of design or by the specifications have been attained for the

(10) Set-up for placing concrete mixture in cofferdam



(13) Concrete laid on radial slope of tunnel bore

long time period of use. This mixture could have been used with another type of spreading machine recently placed on the market. The introduction of a machine to fabricate this kind of mixture is significant. It will develop a market for surplus intermediate sizes providing the aggregate industry gets into the picture before the engineer devises practices to take out another nickel's worth of cement.

No. 8 shows the origin of additional sources of subsequent undesirable behavior of the pavement. The mixture is so harsh that the spreaders avoid the effort required to keep a uniform load in front of the finishing screed. On one side the accumulated large rock has been pulled down onto the subgrade, on the other side the mucker depends upon the machine to get rid of it in some way. The difference in the imposed load affects the consolidation of the concrete passing under the screed. The result is a lack of uniformity of fabrication. The difference in strength

(12) Truck delivery of concrete to be laid in tunnel bore

of cores taken from pavements constructed in this manner has been found to be nearly 100% of the average strength.

An aggregate producer has little chance of selling a premium aggregate under these conditions. The statement by the operator to whom reference was made at the beginning of this article seems to be confirmed.

Trend Toward More Intelligent Use of Aggregates

However, the trend is for better application of the laws of concrete physics and economy. A producer who realizes the value of the engineering research carried on by his industry's association should see that better usage is bound to come. The reports on this research are frequently available in the various issues of Rock Products, and should be considered as to the effect upon the industry just as seriously as these same reports are studied by material and research engineers who direct the use of aggregates. The facts supported by this research eventually find application in specification.

The foregoing illustrations, while typical of numerous concrete operations, are from a special project designed to confirm certain suggestions incorporated in one of these reports. The experience on that project forms the basis for specifications and methods proposed to prevent excessive waste of sizes theretofore considered unusable. Now that new equipment is available and methods have been confirmed as reasonably satisfactory, this type of mixture and the new tool will become competitive with other mixtures and other tools and methods.

Effects of Vibrating Concrete Mixtures

The importance of considering existing tools and methods of manufacturing concrete as affecting the desirability of aggregate may be illustrated by a second set of pictures showing structural concrete designed to be consolidated by vibration, but which must be of such a workable character that handling and transportation tools and methods do not destroy its uniform texture before fabrication. The essential condition of concrete which is to be fabricated by vibration is that it shall be plastic at the time of fabrication and that it shall contain no free water. The problem in designing such a mixture is to use aggregates that contribute cohesiveness, friction and particle interference to the right degree without the use of an excessive amount of cement. The advantages of such mixtures are numerous and warrant the payment of some premium for aggregates that contribute to this mass mechanics.

The second series of illustrations shows structural concrete made with five and six sacks of cement, that can be transported with inclined belt conveyors, chutes, pipe lines, trucks or buggies. The amount of cement has little influence on the mixture so far as utilization of these tools is involved.

Nos. 9 and 10 show an underwater concrete mixture and the tools with which it is placed in the cofferdams at less than 50 ft. depth. For depths greater than this, buckets replaced tremie pipes. No. 11 shows that concrete seal after dewatering of the cofferdam. The white spots are laitance. The mixture is dominated by coarse aggregate but is of such mass properties that it flattens in the bucket and under water. No. 12 illustrates truck delivery of concrete similar to that shown in No. 15, to be pumped to the crown seat haunch and laid on the radial slope of the tunnel bore. No. 13 shows this concrete laid to this slope. No. 14 shows similar concrete delivered by truck to a head box on a chute discharging into a transfer box. These boxes or equally effective cone trays are used along all chute or conveyor systems as shown on the boom belt in No. 9. No. 13 illustrates buggy delivery. (Note that the contractor has used rubber tires to save runway lumber and to insure against acci-

(14) Concrete delivered on chute discharging to transfer box

(15) Dumping of workable concrete for tunnel bore

dental dumping due to obstacles on the runways. There are perhaps fifty men working below this level, and the ease with which concrete buggies with pneumatic tires are controlled is assurance against accident.) No. 14 is a picture of the concrete after vibration is nearly completed. Capacities exceeded the contractor's estimate.

Evaluating Premium Aggregates

The special quality of the concrete exhibited in these illustrations is uniformity. The average results exceeded those proposed by the specifications. The outstanding result of concrete practice on this project was the exhibition of the properties of the aggregates that contribute to workability.

The two cases illustrated in this article are typical of exhibitions of concrete manufacture that affect the aggregates industry. They represent the differences of opinion between two schools of thought concerning the means of making basic principles of concrete physics effective. The standards of these two schools are probably theoretically the same. The differences appear to be related to the significance attached to known factors that affect concrete properties. If it is conceded that one or more of these factors is more important, then it must be conceded that usually concrete practice is correct.

If, however, concrete must be plastic at the time of fabrication, there must exist some evidence on all work that one material is more desirable than another. If the engineer does not agree with the producer as to the kind of evidence that proves a premium aggregate, the producer need not be discouraged. The engineer may be wrong, but he will be the exception if he does not change. Most of us change, and conditions change.

The producer who wishes to change the market to appreciate any good in his product will do so if he always makes a good product. Most engineers act as their experience dictates. The inherent urge is to justify events. Given time and no aggravating circumstances, the engineer will modify his methods of application of basic principles to conform to existing materials. If skill in operation is required to make a good aggregate, then skill can be rewarded. If capital is required to buy equipment to make a good aggregate, then capital will be rewarded. If both are needed, both will be rewarded. If there is a market and a producer is not participating, he should analyze his sales methods and plant operation to see if he has conformed to this philosophy. If not, he should consult himself and the aggregate equipment engineer.

The operator who inspired this article makes exceptionally good uniform products. He has one of the best equipped plants in the West. His operating and sales staffs are skilled. He has been selling a considerable amount of material throughout the depression, in fact more than his quota of the capacity in the area. It may not be enough to make a profit, but most of it comes unsolicited except that one order well filled calls for another from the same source.

With the advantages of new equipments which have recently been installed, this producer will get his share of any increase in business.

Need Up-to-Date Equipment in Plants

There are several significant incidents recalled to the mind of the writer in reviewing this article. The plants making preferable materials are equipped with the latest types of sand classifiers, screens, crushers, etc. Furthermore, these equipments are operated in accordance with the manufacturer's instructions. In a few small plants, home-made sand boxes or drag classifiers are in operation, but in most of these cases the producer knows the limits of these home-made tools.

(16) Vibration of placed mix affects premium on aggregates

These operators are regularly visiting the work and discussing the customers' problems with the field men. These same men know in some manner when the writer is expected to visit the job in his official capacity. They understand and discuss the technical reports in the latest issue of the ROCK PRODUCTS and other publications.

And last, and more important to them, they must look over the advertising, because a regular question takes the form of "Is what's-his-name's new equipment eliminating the trouble he was having with your special provisions?"

In a succeeding article Mr. Hands will discuss "Profit Opportunities of Fine Sand and Vibration." Watch for it.—The Editor.

Silicosis Laws in Effect

New York State's three bills designed to protect workers in industries affected by silicosis or other dust diseases were signed, June 9, although Governor Lehman in a memorandum stated that "certain provisions of this legislation are not at all to my liking" and that they "run counter to what I have believed to be sound principles of workmen's compensation laws."

"The protection of the workingman from exposure," the Governor's memorandum pointed out, "to conditions which develop silicosis and other dust diseases is a very long step forward. Hereafter employers must use dust elimination devices approved by the Industrial Commissioner," he declared.

An appropriation of $100,000 is made to enable the Industrial Commissioner to enforce this preventive requirement. Furthermore, it is also provided that $50,000 annually, beginning July 1 and extending to June 30, 1941, may be taken from the state vocational rehabilitation fund for making studies to prevent dust diseases and to devise methods of eliminating such hazards.

New Plant

Wissota Sand and Gravel Co., Eau Claire, Wis., has leased a gravel pit at Ladysmith, Wis., from Chas. D. Swaim and, it is reported, will immediately construct a screening and washing plant. A spur from the Soo Line railroad is being laid to the pit.

Uses Power Shovels

WPA in Wisconsin is turning to the use of power shovels on several sand and gravel projects in order to obtain a requisite amount of material. Various WPA quarry projects in "the typical prairie states" have been driven lately to the use of power shovels for loading because men who will do that kind of work are reported actually to be getting scarce.

Marble Dust and Acid Make CO_2

Alabama Marble Co., Gantts Quarry, Ala., is reported to be manufacturing carbon dioxide (CO₂) for the beverage trade by treating pulverized marble with acid.

WPA Uses Power Shovel

Fairfield, Ia., quarry project, operated by WPA labor, is reported to have installed a rented power shovel because relief labor is getting scarce.

Punishment: Census to Quarry

St. Louis, Mo., "white-collar" workers on WPA payroll have been transferred "for the good of the service" from census jobs to breaking stone in local quarries. The five men involved were members of the executive committee of a labor union of government employes.

Adds Equipment

W. C. Busick, Osceola, Ia., has recently increased the capacity of his crushing plant by addition of new equipment designed to make 300 tons of crushed stone or 150 tons of agricultural limestone per day.

Government Rip-Rap Quarry

Alphonzo E. Bell, Los Angeles, Calif., who a few years ago tried to promote a portland cement plant in Santa Ynez Canyon, has succeeded in getting the U. S. government to open up a limestone quarry on the property. Some 5760 tons of rip-rap are being quarried per day for flood protection and waterway projects on the Los Angeles river, Lower Ballona creek and Compton creek. About 2500 men are employed.

Visitor Returns Home

Thomas Swan, prominent British producer of crushed stone and lime, vice-president of the Institute of Quarrying, returned to his home at Herts, England, recently after a short visit in the United States in which he covered the country from New York to New Orleans to San Francisco to Chicago and back to New York. He visited with the editor of ROCK PRODUCTS in Chicago and with several crushed stone producers in the East, where his son is a graduate student at the Harvard University school of business administration. While in the East Mr. Swan visited the National Crushed Stone Association offices and laboratory, at Washington, D. C. He will tell his British contemporaries his impressions of the American industry at the annual conference of the Institute of Quarrying at Bocombe, Bouremouth, September 28-October 1, 1936. American quarry operators who may be visiting England at that time are invited to attend.

Prices Bid—Contracts Let

Worthington, Ohio: J. and R. Smoufer Co., has been awarded contract for village crushed stone needs, a minimum of 400 tons, at $1.15 per ton delivered. Only other bid, $1.20.

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Pittsburgh, Penn.: Bids to furnish and deliver 500 bbl. of cement, opened by U. S. Engineer Office, Pittsburgh, were 13 in number, all $2.13 per bbl.

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Lincoln, Ill.: Macon county highway committee awarded contract for 1000 cu. yd., graded gravel to McGrath Sand and Gravel Co., Lincoln, at $1.69½ per cu. yd. Other bids were: Lehigh Stone Co., Kankakee, $2.06; Materials Service Co., Chicago, $2.15.

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Yakima, Wash.: Price of sand and gravel alone for 10 miles of canal on the Roza unit will be $185,250 plus freight. This was determined on the opening of bids at the office of the U. S. Reclamation Service. This section of the canal is only one unit for which construction funds are available. Woodworth & Cornell, Tacoma, were low bidders on the upper section at $113,050 and the Yakima Sand & Gravel Co. low on the other section at $73,200.

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Huntington, N. Y.: Town authorities insist on fulfillment of contract made with Steers Sand and Gravel Co. for sand and gravel to be used on WPA projects at delivered prices of 20c per cu. yd. for sand and 90c per cu. yd. for gravel. Other bids ranged from 58c to 90c for sand and $1.20 to $1.90 for gravel. It is reported the Steers company asked to withdraw its bid after competitors had protested the prices as prohibitive.

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Tipton, Ia.: Cedar county awarded contract to Concrete Materials Corp., Waterloo, Ia., for 16,190 cu. yd. of class A crushed stone at $1.67 per cu. yd.

• • •

Grundy Center, Ia.: Grundy county awarded contract for road gravel to Concrete Materials Corp., Waterloo, Ia., at $1.44 per cu. yd. delivered on road projects; total 41,000 cu. yd.

• • •

Cullom, Ill.: Saunemin township has awarded contract for road gravel for 14.7 miles of surfacing to Churchill Gravel Co., Pontiac, Ill., at $1.44.

• • •

Rock Island, Ill.: Rock Island county will buy cement requirements under an existing contract direct from Dewey Portland Cement Co., Davenport, Ia., at $1.84 per bbl. net (without sacks) at Milan and $1.86 at Wagner Crossing. Recent bids by Dewey, Alpha and Marquette were all $1.99 net, and the cement was to be sold through dealers.

Nashville, Tenn.: Davidson county highway department supplies for 12 months have been contracted for as follows: crushed gravel, T. L. Herbert & Sons and Franklin Limestone Co., both of Nashville, $1.50 per ton.

• • •

Fond du Lac, Wis.: City street department awarded contract for year's supply of sand, gravel and crushed stone to Lake View Sand and Gravel Co.: 5000 cu. yd. of washed sand at $1.05 cu. yd. at pit, or $1.49 delivered; 5000 cu. yd. of crushed stone at $1.19 or $1.59; crushed gravel at 55c or 98c.

• • •

Syracuse, N. Y.: Onondaga county let contract for 3000 tons of concrete sand to General Crushed Stone Co., Easton, Penn., at $1.65 per ton delivered to county concrete-mixing plant. Only other bid $1.24, sand failed to meet tests.

• • •

Ames, Ia.: Story county board of supervisors awarded contract for 91,500 cu. yd. of road gravel to Ray Cook, Ames, at 59.6c per cu. yd., delivered.

• • •

Harrisburg, Penn.: City awarded contracts for highway department materials to J. E. Baker Co., York, Penn., limestone dust, $3.50 per ton; Pennsylvania Supply Co., sand, $2.14 per ton; Bethlehem Steel Corp., crushed stone, $1.42 per ton.

A 20-Year Flux Contract

Kelley Island Lime and Transport Co., Cleveland, Ohio, President G. J. Whelan, following the company's annual stockholders' meeting, said, had recently closed a 20-year contract with one of the large steel companies for 800,000 tons of fluxing limestone per year. In a normal year this steel company consumes about 1,400,000 tons of flux. Earnings thus far in 1936 are said to be 25% ahead of 1935, when the company showed a net profit of $327,698. Sales are reported 35% ahead of 1935.

Crushing Plant

F. N. Crane, Miami, Fla., has been granted permission by the city authorities to establish a rock-crushing and washing plant east of Wagner creek at N.W. Tenth ave. He has purchased the rock spoil bank there, deposited by contractors when the Miami river was widened.

Shell Crushing Plant

Balfour, Guthrie & Co., Seattle, Wash., is reported to be seeking a site at South Bend, Wash., for a shell crushing plant.

New Crushed Stone Plant

L. Romano Engineering Corp., Seattle, Wash., has established a quarry and crushing plant at Riverton. Blue basalt is the rock quarried.

MODERN *Methods* used in this plant's production of WASHED *Crushed* STONE

One Saving is in Stripping; Costs Cut Two-Thirds

MODERN METHODS of quarrying and efficient processing of rock feature the new plant of the Louisville Crushed Stone Co., three miles from Louisville, Ky., in Jefferson County. Construction of the plan was begun in June, 1935, and since its completion in September, 1935, a full time operating schedule, except for a short shutdown during the most severe winter weather, has been maintained.

Diesel-powered scraper stripping at Louisville Crushed Stone Co. plant

Quarry

The deposit is a dolomitic limestone, extending 36 ft. below the present quarry floor, which has been worked in two benches of 20 and 16 ft. over two acres since operations started. Fifty-five acres of land were bought outright, insuring a substantial supply of rock. The face is semi-circular in plan, with the imaginary center located approximately at the primary crusher.

Stripping of the overburden, averaging 6 ft. in depth, is accomplished cheaply and efficiently by means of a Le Tourneau 12-yd. scraper driven by a 75-hp. Caterpillar Diesel. According to F. H. Lanham, general manager, stripping costs are cut to one-third of the usual costs when more conventional types of handling overburden are used.

Approximately 1000 yd. of material are handled in a 10-hr. day and an even grade is maintained while stripping. The most efficient method of operation has been one where the scraper is set to cut to a depth of 1½ ft., and a full load is handled at all times. In a comparatively short time, all necessary stripping is accomplished to uncover sufficient rock for a season's run, and the Le Tourneau scraper is shipped away to be used in other operations.

Scraper in foreground, with crushing plant and canal in background

Blast-Holing

An Ingersoll-Rand wagon drill is used to drill all blast holes to a diameter of 1⅞ in. at the bottom. Two rows are loaded and shot simultaneously. One row is drilled back 5 ft. from the face with 5 ft. between holes, and the second row holes are spaced 5 ft. apart and 5 ft. back from the first row. The holes are staggered and are drilled 6 in. lower than the quarry floor, to maintain a level floor.

Hauling to Crusher

Rock is hauled from the quarry shovel to the crusher by three 3-yd. end-dump Ford

Flexible quarry operation, showing large quantity of rock removed

Shovel filling 3-yd. end-dump truck

V-8 trucks. The trucks have specially reinforced floors, and the drivers are protected by heavy steel cabs. Rock is loaded by a 1½-yd. gasoline-driven Koehring shovel. Rock upwards of 3 ft. in diameter are handled successfully in these light trucks.

A system of all-weather rock roads of two-car width has been built from the quarry floor to the primary crusher, so that a truck can haul up the 15% grade, dump into the crusher, and turn around in a forward direction to go back to the shovel for another load. At present, the haul to the crusher is approximately 500 ft.

Crushing

The crushing and screening plant is designed to make the utmost use of gravity, with a minimum of elevator equipment. It is located on the side of a slope, dropping off sharply in the direction away from the quarry. This slope has been built up further to a height of approximately 25 ft. above the footings of the screening plant below by filling with rock and earth. This makes it possible to have the primary crusher set on the crest and the secondary crusher directly below on the side of the vertical drop-off.

The primary crusher is a 28x36-in. Traylor "Bull-Dog," jaw type, driven by a 100-hp. General Electric motor through a 14-in. belt drive. Often larger rock than the crusher is designed to handle are hauled to the crusher. These are put through the crusher with a minimum of tie-ups by the help of a hook-bar operated by a Robins-Meyers 2-ton electric hoist. Two steel 8-in. H-sections 12 ft. high serve as columns on opposite sides of the crusher feed, with a 16-in. I-beam, 12-ft. long, as a cross-member. The hoist travels on this I-beam.

After passing the jaw crusher, rock falls directly to a type TZ Traylor 3-ft. gyratory secondary crusher, driven by a 75-hp. Fairbanks-Morse slip ring motor through a 14-in. belt. The product of this crusher flows by gravity to a Link-Belt bucket elevator with 24-in. by 11-in. buckets, to be raised to the screens. The elevator has 62-ft. centers, with the lower end set in a reinforced-concrete pit 10-ft. deep.

Screening

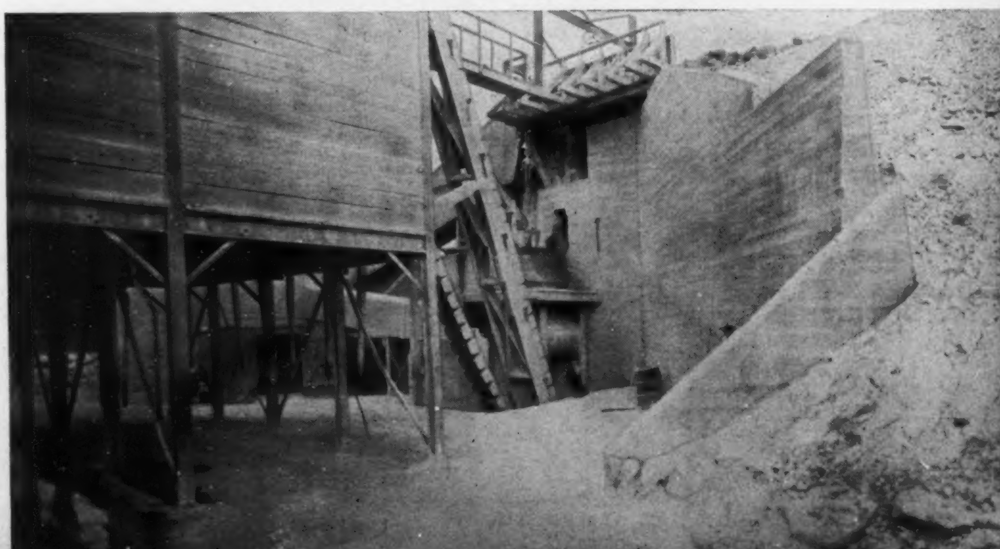
The elevator discharges to a 4x12 ft. Robins triple-deck vibrating screen, below which is set a similar Robins screen. Oversize from the top deck of the first screen passes by way of a chute back to the reduction crusher, and is re-elevated by the same elevator to the same screen. A typical run is with the upper screen having 2½, ½ and ¼-in. mesh on its decks from top to bottom, respectively. The second screen has 1¼, ¾ and 3/16-in. mesh on its decks. Rock over 2½ in. goes back to the reduction crusher, after which it passes over the screen again.

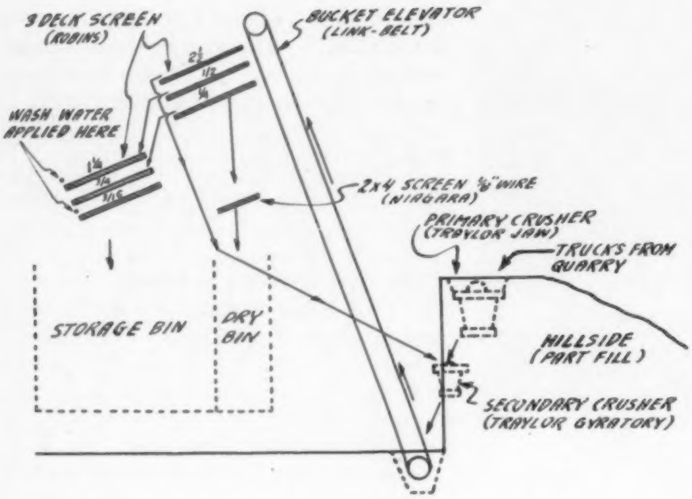
Material passing the 2½-in. but retained on the ½-in. passes to the top deck of the lower screen, where 1¼ to 2½-in., ¾-in. to 1¼-in., etc., are separated out. Similarly, rock passing the ½-in. mesh of the first screen, but retained on the ¼-in. screen passes to the second deck of the lower screen. All washing takes place on the lower screen. Minus ¼-in. material from the first screen passes to a 2x4-ft. single deck Niagara screen, driven by a 3-hp. G.-E. motor, where the ⅛-in. to ¼-in chips are separated out, after which they pass by gravity to a 70-ton steel dry bin. A 20-hp. General Electric motor drives the bucket elevator through a V-belt drive, and a 7½-hp. Fairbanks-Morse motor drives each of the Robins screens through a V-belt drive.

Washing

An adequate source of water for washing aggregate without an excessive power requirement furnished a problem to be solved. The nearest source of supply was Bear Grass Creek, located 1000 ft. away from the plant. A canal 20 ft. wide and approximately 15 ft. deep was excavated by means of a clam-shell crane from the creek to a point 100 ft. from the plant. This canal was dug with a slope to permit the creek water to back up the canal to a sump at its upper end, where the pump house was built. An American centrifugal pump supplies the washing plant with 600 g. p. m.

Primary crusher set directly above secondary crusher





Flow sheet of Louisville Crushed Stone Co. plant

through an 8-in. suction and two 6-in. discharge pipes. The discharge is split to cut down on some of the frictional losses. The top and lower decks of the lower screen are sprayed through 4½-in. perforated pipes. Wash water is returned to a settling pool for clarification, after which it passes back to the pump. The pump is direct-connected to a 50-hp. General Electric motor operating at 3600 r.p.m. After the rock is sized, it is stored in eight steel bins, each of 80 tons capacity. These bins were fabricated by the Louisville Bridge Co.

Ever since the plant was finished, it has enjoyed a business requiring an average operating day of 10 hours. Finished rock is only stored when it is to be hauled on short notice to a particular job of size. At present 6000 cu. yd. are stored for a road job. The plant operates just long enough each day so that the bins are filled each night. This procedure has so far required an average of 10 hours daily.

The company has twenty-one 2- and 3-cu. yd. Ford trucks for hauling rock from the bins or stock piles to the jobs. The capacity of the plant is 85 tons of crushed rock hourly. So far, most of the jobs furnished are WPA road projects, county roads and city asphalt jobs. The ½ to 1¼-in. stone is generally used for asphaltic roads. Considerable of the 1¼-2½-in. stone is being used for base rock for county roads, with about 10% of the ¼-in. minus dust as binder material.

It is expected that some concrete aggregate business will be available, but there is no permanent road program in sight for Kentucky. Reduction in automobile license rates plus diversion of road monies has resulted in most of the state road work being for retreading surfaces only.

Canal and pump house

A new office building has been built in connection with the home of Mr. Lanham at the plant. All material is weighed on a new 10,000-lb. Fairbanks-Morse automatic scale. A separate building houses a Sullivan 2-stage air compressor and the 100-hp. motor driving it, and another large building has been erected to house the trucks. Electric power is purchased from the Louisville Gas and Electric Co. The rated horse power of the plant is 375, although the average power used is 280, due mainly to the intermittent operation of the crushers.

Use for Old Quarry

A shooting gallery is the use made of the old "Lime City Quarry," Tipton, Ia. "Vigilantes" of neighboring towns practice pistol and rifle shooting there on Sunday afternoons. This may give an idea to owners of old quarries who can think of no other use for them than as swimming holes.

Men Show Sense

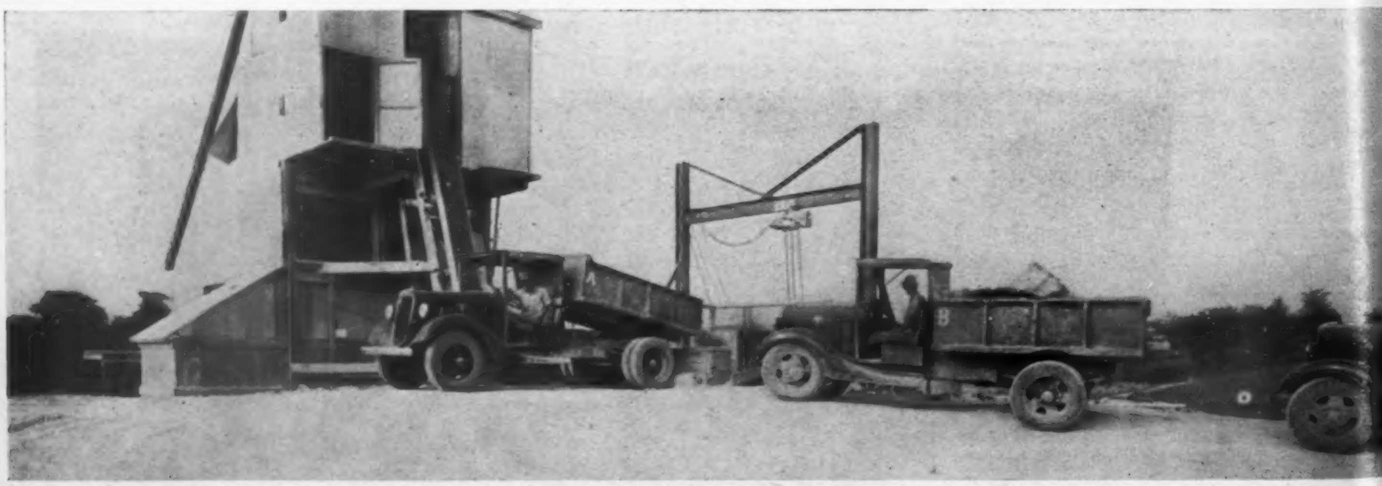
WPA quarry project near Centerville, Ia., ceased operation recently, temporarily at least, because the men would not go to work in the quarry on account of several unexploded blast-hole charges. The supervisor "believed" he had removed all the unexploded charges.

Big Blast

Pounding Mill Quarry Corp., Pounding Mill, Va., exploded 35 tons of dynamite on May 28. Some 175,000 tons of stone were brought down. C. M. Hunter, vice-president of the company, said it was the largest shot in his 23 years' experience.

Plant Projected

Kansas City Quarries Co., Kansas City, Mo., has been organized by W. M. Spencer and a 120-acre quarry site at 114 South Kentucky St., is to be developed and a crushing plant erected. The business will include ready-mixed concrete, using truck mixers.



Truck discharging into primary crusher

Reopened For Business

Lake Shore Sand and Gravel Co., Erie, Penn., with plant at Fairview, Penn., has been reorganized and is back in production after a period of inactivity. James R. Berry is plant manager. Offices have been opened in the Marine bank building, Erie.

New Plant

Alfonso Mercoli, Landisville, N. J., has recently put a new sand plant into operation.

New Company

Tacoma Gravel and Supply Co., Tacoma, Wash., is a new corporation organized by Harold Stouffer and P. H. Bowman, of the Stouffer-Bowman Co., Aberdeen, Wash., building supply dealers, to build and operate a sand and gravel plant. The pit purchased is a 20-acre tract three miles from Tacoma on the Puyallup road. Mr. Bowman is to be the manager of the Tacoma plant.

Fire Loss

Portland Sand and Gravel Co., Mt. Bethel, Penn., plant was damaged by fire, May 28, with an estimated loss of $28,000, partly covered by insurance.

Dissolved

Milford Sand and Gravel Co., Milford, Ia., was dissolved at a special stockholders' meeting, May 14. Grant McGowan and George F. Sokol were authorized to wind up the affairs of the company and sell its property.

Electrifies Plant

Lewis County Gravel Co., Centralia, Wash., has recently made many improvements to increase its productive facilities, including connection with the city's electric power lines. Gus A. Nelson is owner-manager.

Fatal Accident

McGrath Sand and Gravel Co., Chillicothe, Ill., plant had a fatal accident May 26 when a 62-year old employe was killed by electricity, short-circuited through a pile of iron pipe. An investigation is said to have disclosed a contact between a portable power cable lying over the pile of pipe some distance from the point where the workman came in contact with the pipe.

Title To Gravel Property

State of Mississippi has brought suit for $400,000 against several individuals at Gulfport for alleged removal of 300,000 cu. yd. of sand and gravel from Bayou Bernard, Handsboro. The suit contends that the title to the bottom lands in tidewater streams is in the state, and that the portion of the bayou dredged for sand and gravel is part of the public domain.

Dynamite Prices Cut

LEADING MANUFACTURERS of explosives have reduced the price of dynamite recently as much as 1 cent a pound in some sections of the country and for certain types of business. Reductions generally, however, do not amount to as much as this.

New Project

A. M. Arpin and **Leslie L. Lyon,** Greenville, Miss., are reported locally to have secured gravel rights at Glen Allen on what is known as Lake Washington and will erect a new screening and washing plant, also a concrete products plant. Excavation of the deposit will probably be by hydraulic dredge.

Changes Ownership

C. M. Martin, Escondido, Calif., has purchased the sand and gravel plant formerly owned by **Webb Brothers**. The plant has been moved from Howell Place to the upper end of Lake Hodges.

New Product

Rex Elledge, Trenton, Mo., is reported to have invented a process of making a concrete product which closely resembles natural granite. He intends to apply the process to the manufacture of concrete burial vaults.

New Development

Henry Hall, Lubbock, Tex., is developing deposits of silica and bentonite on 1500 acres.

Sales Agents

United States Gypsum Co., Chicago, Ill., has been appointed exclusive selling agent to the building industry of glass wool made by the Corning Glass Co., New York City. The U. S. Gypsum Co. also sells the glass wool product of the Owens Illinois Glass Co. Products of both glass companies will be marketed under the U. S. Gypsum Co.'s trade name "Red Top Insulating Wool."

Rock Wool Byproduct

Tennessee Products Corp., Rockdale, Tenn., resumed production of ferro phosphorus on June 1. One unit of the plant, which manufactures tensulate or rock wool, has been in operation during the time the main plant has been closed. This rock wool is made as a byproduct from the slag produced in the manufacture of the phosphorus of iron.

New Development

American Diatomite Co., Clermont, Fla., H. C. Brown, manager, plans to develop deposits of diatomite about 18 miles from Clermont.

To Be Reorganized

Universal Sand Co., New Castle, Penn., is being reorganized under a federal court trusteeship, and the plant is being operated. It will be rehabilitated. Samuel Mooney and Frank O. Moretti are the trustees.

New Operation

Gasconade Sand and Gravel Co., Gasconade, Mo., has a new dredging operation on lands bordering on the Gasconade river. Robert Higgins, St. Louis, Mo., is president.

Hires Agency

Best Brothers Keene's Cement Co., Medicine Lodge and Sun City, Kan., with general sales office in Chicago, Ill., has appointed the Buchen Co., Chicago, Ill., its advertising agency. Trade papers will be used.

New Plant

Atlantic Brick Co., Watertown, Mass., a subsidiary of the Watertown Builders Supply Co., manufacturer of sand-lime brick and block, cement brick and concrete block, has acquired the services of C. H. Carmichael as manager of its new sand-lime brick department. Mr. Carmichael is a past-president of the Sand-Lime Brick Association and was formerly with the Medfield Brick Co., Medfield, Mass.

Sand-Lime Brick Production and Shipments in May, 1936

THE FOLLOWING DATA are compiled from reports received direct from producers of sand-lime brick located in various parts of the United States and Canada. The accompanying statistics may be regarded as representative of the industry.

Nine active sand-lime brick plants reported for the month of May, this number being the same as that reporting for the month of April, statistics for which were published in June.

Average Prices for May

Shipping Point	Plant Price	Delivered
Pontiac, Mich.	$11.00	$12.50
Mishawaka, Ind.	9.25	.....
Syracuse, N. Y.	14.00	16.00-20.00
Saginaw, Mich.	10.50	.....
Sioux Falls, S. D.	12.00	.....
Toronto, Ont., Can.	12.00	13.50

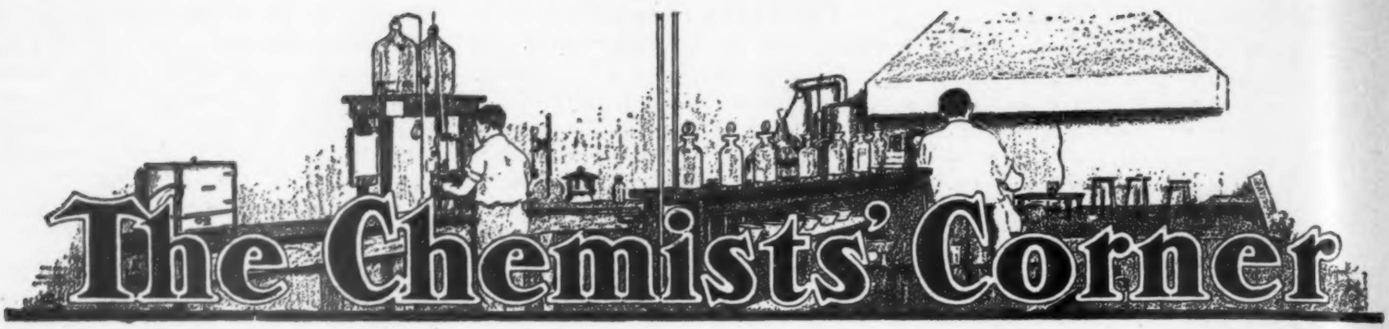
Statistics for April and May

	April†	May*
Production	1,449,150	2,278,050
Shipments (rail)	143,000	137,000
Shipments (truck)	1,688,015	2,162,609
Stocks on hand	1,102,939	1,083,991
Unfilled orders	1,753,400	1,380,000

†Nine plants reporting; incomplete, two not reporting unfilled orders. *Nine plants reporting; incomplete, three not reporting unfilled orders.

Sand-Lime Block

Two producers, in Michigan and Canada, reported production of a total of 99,900 sand-lime block in May, with truck shipments aggregating 120,600. Prices of the block vary, but 13c was reported as the price of the average plain block, 8x8x16-in.



New Process

Production of Portland Cement and Iron— In the Same Rotary Kiln

By Denys Choffat, Engineer,
Barcelona, Spain

A NEW PROCESS has recently entered the field of cement manufacture. It consists in the simultaneous production of cast iron and portland cement clinker in the rotary kiln.

This process was invented by the French chemist, Lucien Basset, was successfully experimented in a French cement plant, and is now being industrially exploited in a dry-process cement plant of the Asland company in Moncada (Spain).

What makes this process particularly interesting is the fact that with a slightly higher expense for coal an ordinary rotary kiln can produce a certain quantity of cast iron having a commercial value superior to that of the cement.

Let us first examine rapidly the phenomena which occur in the portland cement rotary kiln and in the blast furnace.

The raw material for the manufacture of portland cement clinker is a mixture of calcium carbonate and clay, in certain well-established proportions.

Through burning of the raw ground mixture, the following main phenomena are produced:

(1) Expulsion of combined water; this takes place between 870 deg. F. and 1350 deg. F.

(2) Expulsion of carbon dioxide, which begins at 1350 deg. F. and is completed at 1800 deg. F.

(3) A reaction of the liberated lime to form a new compound with the clay. As the temperature rises, the lime and clay combine to form the less basic aluminates and silicates. In the first place, the monocalcium aluminates and monocalcium silicates. On reaching a temperature of 1700 deg. F., the latter begin to change into dicalcium silicate and continue this reaction as the temperature increases. At 2150 deg. F. the monocalcium aluminates, as well as the monocalcium silicates will have disappeared completely, having been transformed into compounds with a greater content of lime. At 2280 deg. F., together with the appearance of the flux, a tricalcium silicate is formed, and this formation continues until the final temperature of clinker formation, which occurs at 2700 deg. F. and over.

> **Editor's Note**
>
> ***The first notice of this new process appeared in Rock Products, June, 1936, issue, page 58, as an abstract of an article in Tonindustrie Zeitung. The reader is referred to that abstract for it contains interesting comment by the cement plant operator. The detailed description herewith was prepared especially for Rock Products by an engineer, who we presume is connected with the inventor of the process. The two articles should be read together as we have tried to avoid duplication as much as possible.***
>
> ***—The Editor***

The clinker thus formed, contains the following three new products: dicalcium ferrites, tricalcium silicates and dicalcium aluminates. A clinker, when prepared in this manner, contains an average of 19 to 23% of SiO_2, 5 to 7% Al_2O_3, 2 to 5% Fe_2O_3, 58 to 67% CaO, and 7% to be divided up between MgO, SO_2 and loss on ignition. The atmosphere created by combustion in the kiln has an oxidizing action.

The charge of a coke blast furnace is composed of ores, flux and the fuel. The burden must produce a slag of definite basicity and fusibility, which vary according to the cast iron one wishes to obtain. The nature of the flux depends on the composition of the gangue of the ore. If the gangue is siliceous (which is most frequently the case), it is necessary to add $CaCO_3$ (limestone); but if, on the contrary, the gangue is calcareous, siliceous materials must be added.

The carbon existing on the hearth at the mouth of the tuyere combines with the oxygen of the injected air and is transformed into CO_2 in the immediate vicinity of the tuyeres; that is, in a higher temperature zone where the iron, already reduced, melts. This CO_2, on entering, in contact with incandescent carbon, returns to its state of CO. The latter then reaches the shaft where it finds the ore heated to a dark red, is oxidized and returns to the state of CO_2, but partly only.

As a matter of fact, in this zone, the ore is either magnetite (Fe_3O_4) or ferroso-ferric-oxide (Fe_2O_3), both containing oxygen which, at a high temperature and in contact with CO, they lose. The CO becomes then CO_2. This is therefore the reduction zone. The iron formed carburizes while passing through several layers of coal, of which it dissolves a certain quantity. The cast iron falls into the hearth, where it accumulates just as fast as formed. The liquid slag also drops into the hearth, but remains floating on the surface on account of its lesser density.

The gangue of the ore, the flux and the fuel ashes are chiefly composed of CaO, Al_2O_3 and SiO_2; these materials combine at a high temperature, to form double silicate of lime and alumina. The atmosphere in the charge of a blast furnace is necessarily a reductive one.

Basset Process of Simultaneous Production

Now that we have seen the principal factors ruling in the working of a blast

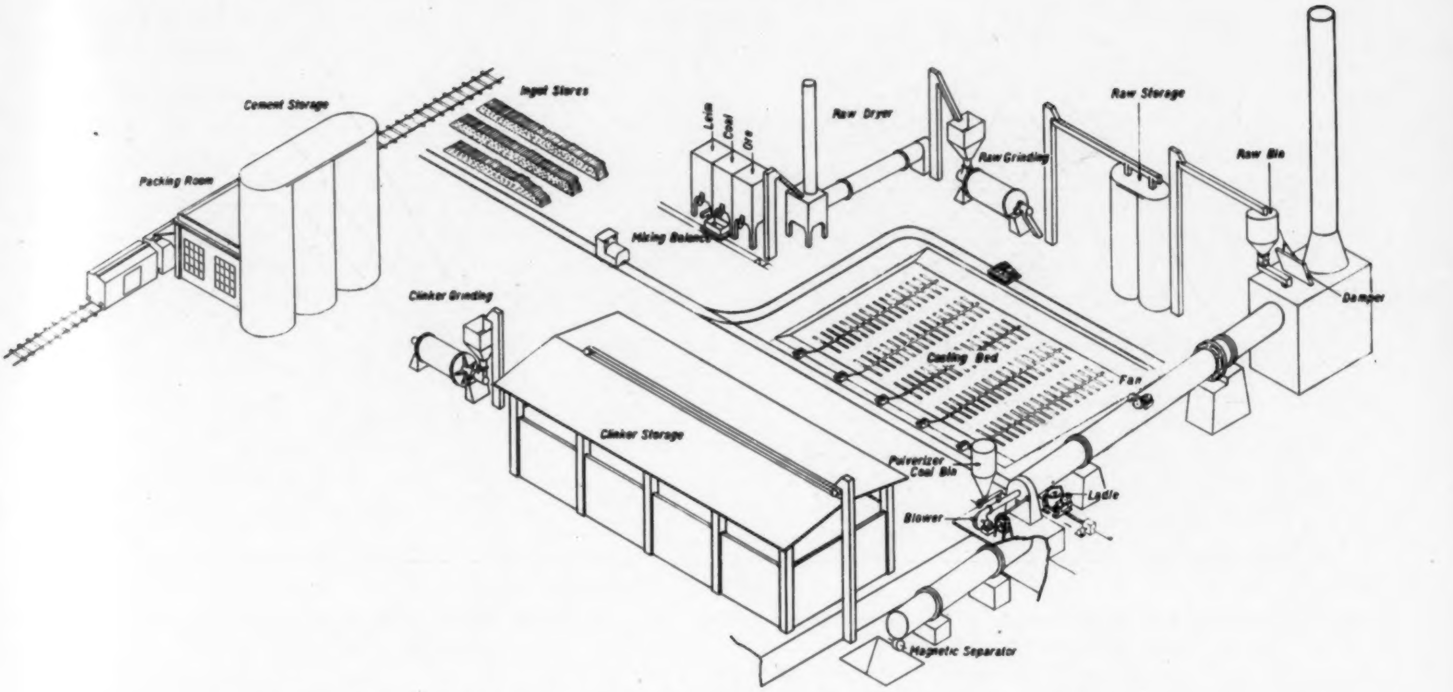


Fig. 1—Schematic drawing of a plant for simultaneous production of cement clinker and cast iron

furnace and of a rotary cement kiln, we shall proceed to the Basset process for the simultaneous manufacture of the cement clinker and cast iron.

As with a blast furnace, the raw materials used in this process are: iron ore, limestone and coal. Reactions in the kiln are similar to those obtained in a blast furnace; that is, reduction of the iron ore, carburization of the iron thus formed and its fusion.

The products are similar to those obtained in blast furnaces; i. e., more or less carburized cast iron on one side, and slag on the other side. This slag is of a chemical composition the same as that of the portland cement clinker. The kiln exit gases also bear a certain likeness to those which escape from blast furnaces.

This process is similar to that of a portland cement clinker in a rotary kiln, by dry or wet process. The raw materials consist of iron ore, limestone and coal. These materials, previously ground and prepared in determined proportions, represent the burden and are brought into the rotary kiln heated with pulverized coal. The iron ore may be of any kind, oxide or carbonate. However, the use of burnt pyrites is of great advantage, as it can be purchased at a much lower rate than any other ore. These burnt pyrites are generally rich in Fe, containing from 50 to 65%. These pyrites must be entirely desulphurized; if this should not be the case, then they must first be completely calcined. A small rotary kiln is suitable for this. Small sized iron ore, difficult to use in a blast furnace, is profitably employed, providing its content of SiO_2 is not excessive.

The limestone may be any one suitable for manufacture of portland cement. It must have a sufficient content of $CaCO_3$ so that the lime may completely saturate the acid elements of the ore and of the ashes of the coal used for reduction of the ore.

The purpose of the coal or carbon which is incorporated in the burden is to reduce the ferric oxide of the iron ores, Peacoals, coal slimes, or culm, or any other cheap coal is preferably used. The content of ashes in these coals only has an effect on the quantity of clinker obtained, for in order to neutralize the SiO_2 and Al_2O_3 of these ashes, one has to use a variable quantity of CaO.

The raw materials are treated in the same way as that commonly used in the manufacture of cement in a rotary kiln. This varies according to whether the plant works under dry or wet process, and in accordance with the existing type of installation.

Features of Asland Plant

In the Moncada dry-process cement plant, the iron ore, limestone and coal which enter in the composition of the burden are weighed carefully. After drying in a rotary drier, these raw materials are ground together in a ball mill. The raw materials thus obtained are stored in the storage silos and after being moistened, are introduced into a dry-process rotary kiln; a feeder regulates the rate of flow.

The water-cooled burner of the kiln has undergone necessary modifications to produce essentially a reducing flame. The fuel is dried and ground as usual in existing installations.

A milling machine has been placed in the front part of the kiln to destroy any adhesions which may form here. In practice this machine has given excellent results. The lining has been given a peculiar shape, so as to strangle a certain length of the kiln in this section, in order to form an obstacle preventing the molten iron from following the clinker into the rotary cooler. At the foot of the wall thus formed there is a tap hole in the side of the kiln which allows the molten metal to fall into a ladle, which has a constant to-and-fro movement. This movement causes the ladle to follow the discharge hole in its course, while discharging.

At each revolution of the kiln, the newly formed cast iron flows out through the discharge hole and drops into the ladle, where it accumulates, while the clinker goes on in the ordinary way and falls into the rotary. A magnetic separator and magnetic drum placed at the output of the cooler pick up the few particles of iron which may eventually have remained in the clinker; these particles of iron are recuperated and returned to the kiln where they will again be molten. The cast iron is immediately cast into pigs, or submitted to further treatment in order to obtain special iron or steel products.

At a certain distance from the molten iron discharge hole is a ventilator on the kiln, which blows in air by means of an angle pipe. The kiln draft is regulated through a water cooled damper which can be moved from the platform of the kiln.

A certain length of the kiln is cooled by a sprinkler system conveniently situated. The purpose of this water spray is to reduce the wear and tear on the kiln lining.

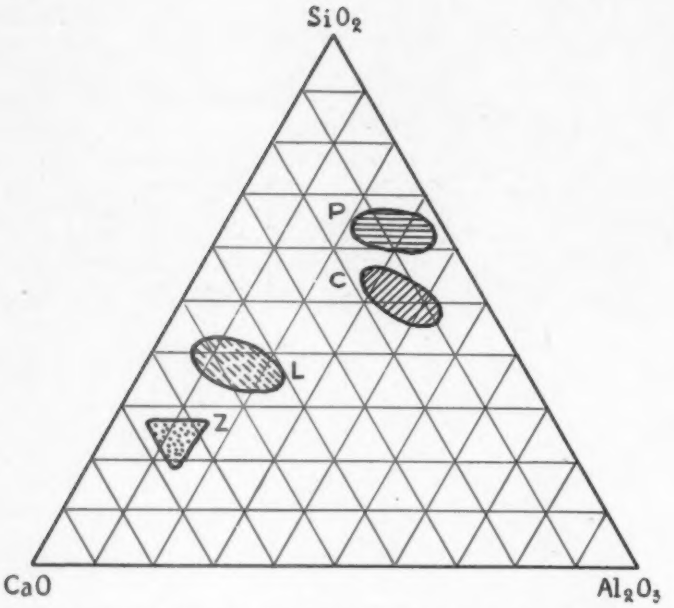


Fig. 2—Ternary diagram showing similarity in composition of portland cement and coke blast slag

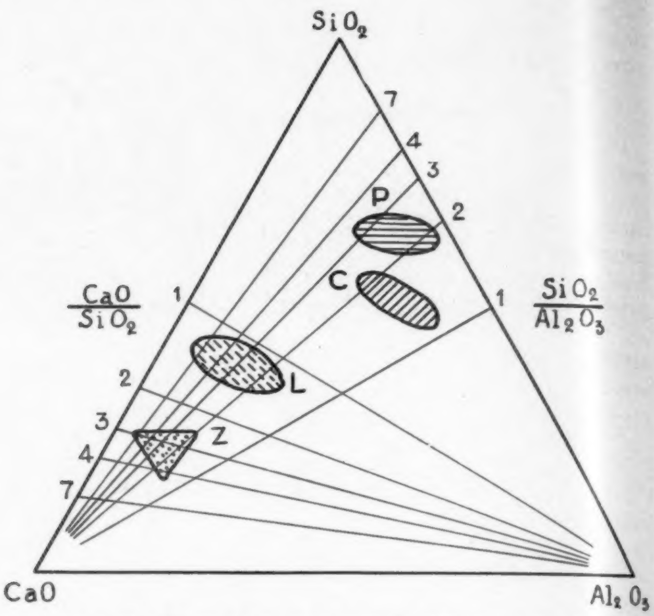


Fig. 3—Ratio of SiO_2 to Al_2O_3 and CaO to SiO_2 in portland cement clinker and blast furnace slag

Similarity of Slag and Portland Cement Clinker

Portland cement clinker, as well as blast furnace slag, are alloys of magnesia, manganese and iron oxides, with compounds of silicate of calcium and aluminate of calcium. In other words, they are products which are part of the same ternary system SiO_2, Al_2O_3 and CaO, but of a different structure.

The ternary diagram (Fig. 2) which takes into account only the chief components SiO_2, Al_2O_3 and CaO, shows very clearly the similitude existing between the portland cement clinker and the slag produced by a coke blast furnace.

In the diagram, Fig. 3, we have drawn lines showing the ratio $\frac{SiO_2}{Al_2O_3}$ and $\frac{CaO}{SiO_2}$. Looking at this diagram we can see that the blast furnace slags have very much the same ratio $\frac{SiO_2}{Al_2O_3}$ as does the portland cement clinker. On the other hand, the ratio $\frac{CaO}{SiO_2}$ is much less for the slag than for the clinker. Therefore, if to a slag of a given ratio of $\frac{CaO}{SiO_2}$ we add a definite quantity of lime, we will obtain a slag with the same composition as that of a portland cement clinker. The ashes and gangue of the ore contain SiO_2 and Al_2O_3 in about the same ratio as in the clinker.

The slag obtained by the Basset process is not any different from a blast furnace slag, except for a higher content of lime. This increase in lime also increases the relative temperature of fusion of the slag and decreases its fluidity.

In the Basset kiln where the ferric oxides contained in the burden are reduced, a reducing atmosphere must be created. Imperfect combustion of the coal in the burner is intentionally produced, in order to obtain a relation $CO:CO_2$ favorable for this reduction and avoid the reoxidation of the metallic iron which has already formed.

Reducing Conditions in Kiln

This reduction probably commences at about 870 deg. F., at which temperature the Fe_2O_3 has a strong tendency to dissociate and produce iron oxide in accordance with the reaction $Fe_2O_3 = 2\ FeO + O$. Between 1350 deg. F. and 1900 deg. F. the FeO is reduced by the CO, and this reduction ends above this temperature through solid C. The reducing action of the gases is all the more intense as the ratio $CO:CO_2$ is greater, and these gases, when penetrating zones of lower temperature, have a lower reductive action.

Nevertheless, these gases contain an important quantity of latent heat which would hardly be utilized if Basset had not found a means of recuperating part of this to heat the burden at the back of the kiln. To this effect, the gases are practically burnt in this section of the kiln by air which is introduced by means of the ventilator. This air must be judiciously administered in order to avoid burning the carbon of the charge and reoxidizing the burden which is just beginning to be reduced.

The fourth diagram, without being complete, gives an idea of the progressive reactions in the kiln. In the upper part, the reactions pertaining to the formation of the cast iron are indicated, whereas the lower part shows those referring to the clinker. As no exact measurements are on hand, the temperatures indicated thereon may suffer some variations. They have been indicated as the most probable.

The preparation zone of the clinker corresponds to the preheating zone of the burden and the beginning of the reduction, according to the reaction $Fe_2O_3 + CO = 2FeO + CO_2$. The latter probably takes place between 870 deg. and 1350 deg. F. The decarbonation zone of the charge corresponds approximately to the reduction zone according to $FeO + CO = Fe + CO_2$ and at a higher temperature $FeO + C = FE + CO$, which reactions take place between 1350 deg. and 1900 deg. F. In the clinkering zone (2000 to 2800 deg. F.) where the components of the clinker are formed, the reduction with solid carbon is terminated, the iron carburates and melts. The cast iron is evacuated at each revolution of the kiln through the tap hole, while the clinker passes through the oxidizing zone and drops into the cooler.

Naturally, the ratio $CO:CO_2$, on the way from the discharge hole to the back of the kiln must be sufficient (reducing atmosphere); if the contrary should be the case, that is $CO:CO_2$ insufficient (oxidizing atmosphere), the reduction would be imperfect. The badly reduced charge which still contains FeO, enters into the melting and clinkering zone. The presence of FeO in this zone produces an easily fusible acid slag which agglomerates, attacking the more basic kiln lining. The metal which could have formed cannot carburate and remains in the shape of very little carburized iron (steel).

Considering the fact that the temperature of the clinkering zone is very high, the charge would attack the kiln lining in this zone, if it were an ordinary silico-aluminous or silico-calcareous lining material. In order to avoid this, a lining of clinker cement agglomerate is used, which

has the advantage that it suppresses any chemical reaction between the lining material and the charge.

Products Obtained

On one side, we will obtain clinker, and on the other cast iron. The quantity of cement produced for each ton of metal varies according to the composition of the gangue of the raw material. The more SiO_2 and Al_2O_3 is contained in the gangue and the limestone, the more CaO will be necessary in order to saturate the acid elements of the burden, and the greater will be the quantity of clinker as compared to that of cast iron. The ratio

$$\frac{\text{clinker}}{\text{cast iron}}$$

can be easily controlled. However, for each plant, with a certain quality limestone supplied by its quarries, there is an economical basis which, with normal quarry and iron ores, varies from 0.8 to 1.5. This means that for 1 ton of cast iron, 0.8 to 1.5 tons of clinker will be obtained.

The cast iron obtained through the Basset process is first rate and will stand comparison with the best Swedish quality hematite cast iron. It is free of phosphorus and completely desulphurized, thanks to the slag which is rich in CaO. It contains very little Si and Mn, about 4% to 4.5% graphitic carbon and 0.02% of combined carbon.

The analysis of a normal cast iron by the Basset process, gives the following results:

Silicon	0.10 to 0.50%
Combined carbon	0.02%
Graphitic carbon	4 to 4.5%
Sulphur	Traces
Phosphorus	0.065%
Manganese	approx. 0.40%

With a reasonable addition of manganese ores, 2.0 to 3.5% Mn cast iron will be obtained, with a metallurgic efficiency of 65 to 70%. Carbon contents 4%. This cast iron will stand comparison with the best "Martin" cast iron, with less phosphorus. Normally we obtain:

Silicon	0.15%
Combined carbon	0.04%
Graphitic carbon	4.32%
Sulphur	Traces
Phosphorus	0.07%
Manganese	2.15%

Thanks to further treatment with ferro-silicon, we obtain, with an efficiency of 94 to 98%, a cast iron of 2.5% and more Si which consists normally of:

Silicon	1.8 to 3%
Combined carbon	0.03%
Graphitic carbon	4.12%
Sulphur	Traces
Phosphorus	0.05%
Manganese	0.40%

This silicon cast iron is obtained either by throwing directly ferro-silicon into the ladle while it is being filled; or else by treating the liquid iron in a small rotary or tilting kiln with the addition of ferro-silicon. This small kiln, into which the metal coming directly from the big kiln is poured, acts as a mixer, making the composition of the cast iron uniform; it also permits eventual solid additions.

The clinker obtained by this process is comparable to the best quality portland cement clinker, with plenty of CaO, very little uncombined lime (0.5%), and is invariable in the boiling test. Tests made in accordance with the present Spanish standard specification have given the following results on 1:3 cement-sand specimens cured under water:

Age—	24 hours	3 days	5 days	7 days	28 days
Tension	210 lb./in²	280 lb./in²	320 lb./in²	330 lb./in²	470 lb/in²
Compression	1700 lb./in²	3000 lb./in²	3300 lb./in²	3450 lb./in²	5150 lb./in²

Initial setting time, after 2 hours and 10 minutes; its final setting time, after about 6 hours 10 minutes. Le Châtelier expansion 1 m/m., 7.3% residue on the 4900-mesh sieve.

This clinker contains from 0.8 to 1.1% iron, in the shape of metal which has been created through its intimate contact with the melting cast iron. The presence, however, of this metallic iron creates no problem, as it can be easily separated from the cement with a magnetic separator at the time of grinding the clinker. The quantity which may remain in the cement is much less than the quantity of metallic iron introduced into the cement through the wear of the balls of the mill.

The Moncada cement plant is equipped with a 9 by 140-ft. Allis-Chalmers rotary kiln. At the time when this kiln was producing normal cement, its daily output was of 150 tons. Under the new process it gives very satisfactory results with a steady and regular production of cast iron and clinker. Its productive capacity is 130 tons of both cast iron and clinker, requiring 750 lb. of coal in the burner per ton of product.

The efficiency of the total operation is near to 95%, that is to say, 95% of the metal contained in the ores theoretically introduced into the kiln are recovered in the shape of metal.

Conclusions

This new process, the same as all new processes, is the result of long and costly researches. The enormous technical difficulties which the inventor has had to face are now solved. The Basset process must from now on be considered as an up-to-date industrial process, which yields positive results and is highly interesting from an economical point of view. This process is bound to take a considerable development in the near future, particularly in countries which do not now produce iron.

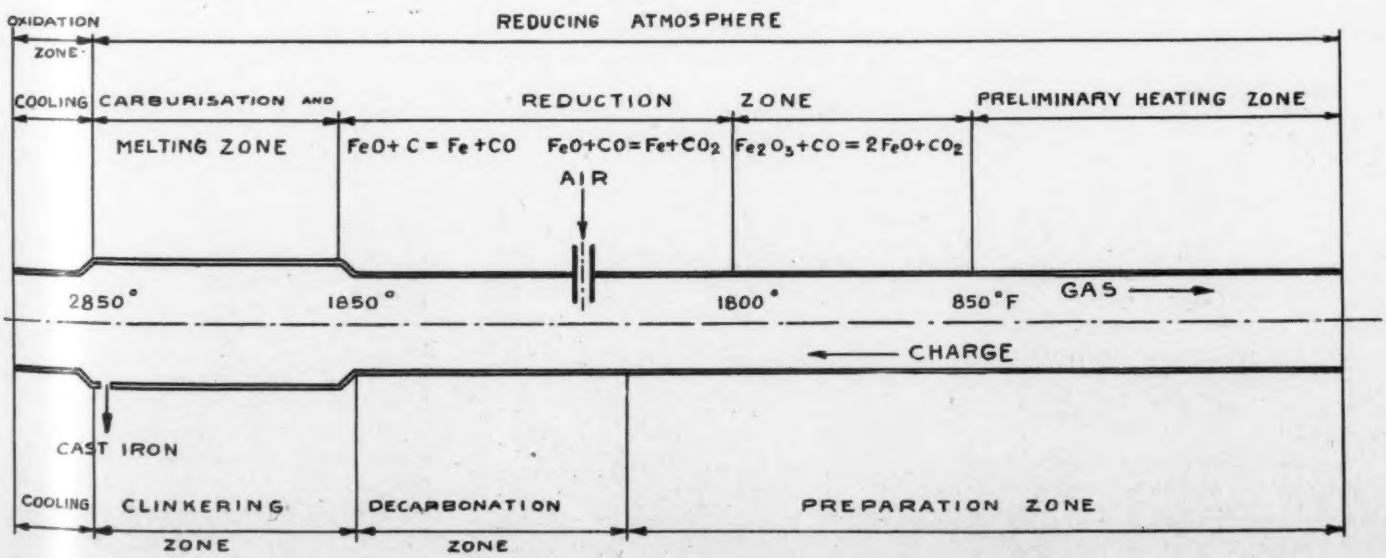
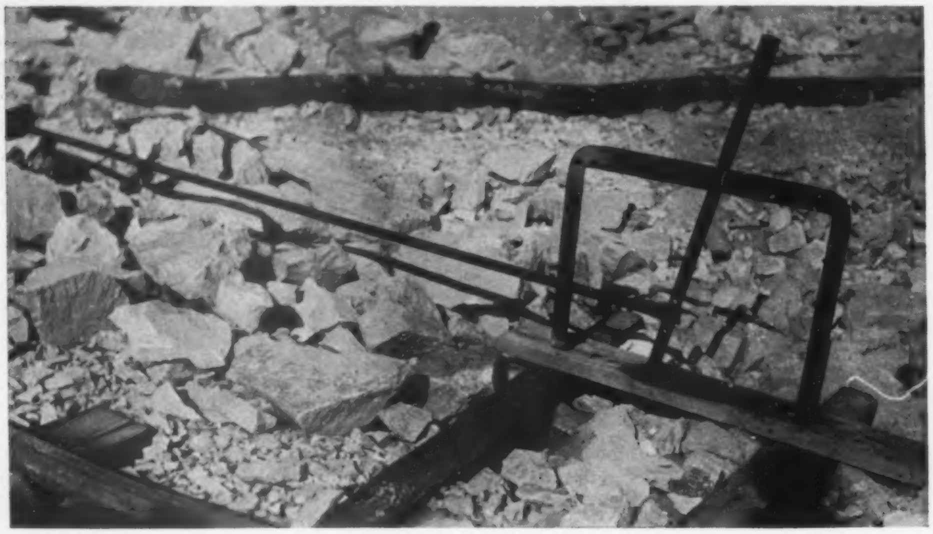


Fig. 4—Progressive reactions in kiln producing iron and portland cement

Hints and Helps for Superintendents



Track switch stand at foot of an incline

Distant Throw for Track Switches

By John F. Robertson,
Superintendent, Cedar Bluff Quarry, Princeton, Ky.

WE USE 24-in. gage track with side-dump cars. It is often a great labor saver and safety device to throw the track switches from a distance. We get rock from three levels in our quarry, at present, and any delay to the trip of cars on the incline means a definite loss of production. Hence, we have two distant throw switches in constant use on the incline.

One of them is thrown by the hoist operator and is located very handily next to his bank of levers. This meant a second set of toggles and a second right-angle throw in the system, but it has worked to perfection The switch is 75 ft. down the incline.

The other switch throw is located at the bottom of the incline and throws a switch 110 ft. up the incline. A gasoline locomotive flagman throws this switch as soon as he comes in with a trip of loads.

The toggles and switch-stands are shown in the illustrations. One-inch standard pipe is used for the long rods, and this is supported by wooden ties notched to fit, with straps placed over the pipe at 10 ft. intervals. The throwing handle is weighted with lead to make it throw more easily.

Toggle 110 ft. from switch

A toggle outside the hoist room

Self-Adjusting Belt Scraper

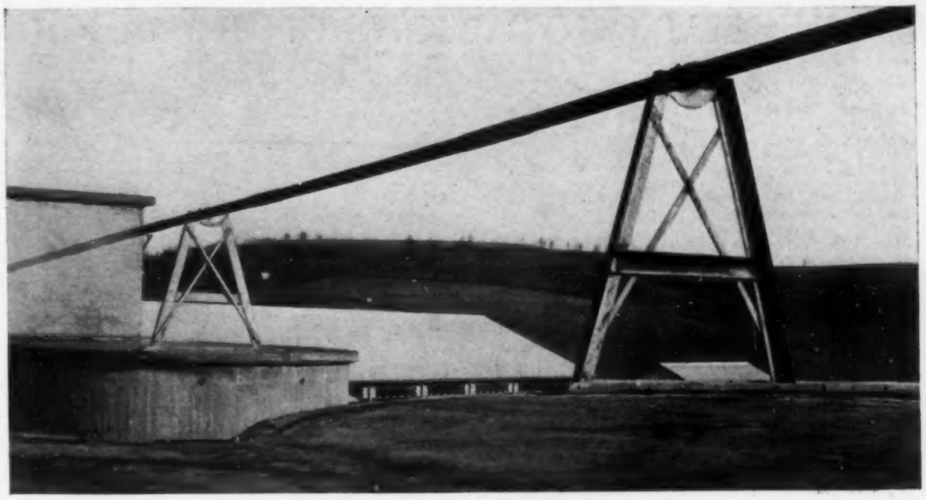
THERE have been many types of scrapers in use on conveyor belts, but the one shown in the illustration has the advantages of needing no adjustment or attention, and of never being in the way. When a scraper is held in place by counterweights, these may need changing occasionally, and the weighted arms are usually very much in the way. The scraper shown is pulled against the pulley at each end by a small coil spring, so that it is always tight against the belt. This scraper consists of a section of belt nailed to a plank, which in turn rests on two blocks, one spiked to either side of the conveyor frame on the inside. The scraper plank is free to move somewhat, but is prevented from turning on edge by strips of strap iron on the side blocks. The coil springs, with one end of each attached to the scraper and the other ends attached to the conveyor frame, complete the mechanism. This simple arrangement adjusts itself to irregular wear on the scraper and has no protruding parts to get in the way. This scraper is in use at the plant of the Janesville Sand and Gravel Co., Janesville, Wis.

Simple belt scraper

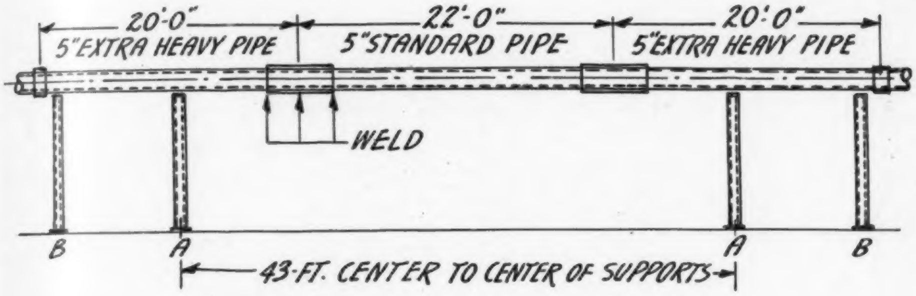
Installing Long Spans of Pipe Line

By E. H. Fleischman,
Keystone Portland Cement Co., Bath, Penn.

IT BEING NECESSARY to cross a 42-ft. gap between two buildings with a 5-in. pipe line, we worked out the continuous beam scheme as shown in sketch. This resembles a cantilever bridge with a suspended span. Supports A were fabricated from channels and angles, while supports B were in place as concrete walls, although they could also be fabricated units. The weight of the span with contents rests on supports A, but supports B keep the pipe from going up. In assembling, the whole length of pipe was welded together on the ground, a sleeve of 6-in. pipe about 3 ft. long split and pounded together to fit tightly over the 5-in. pipe being welded over each joint as a reinforcement. Using this method the maximum bending moment is at the supports A, and is approximately W1/12, W being the weight of pipe plus load in pounds between the supports A, and 1 the distance between these supports in inches.



Long span of pipe line supported by beams



Cantilever bridge arrangement to hold up pipe line

Improving Dredge Pump

By R. J. Hale,
Dreyer Sand Co., Turner, Kan.

THE FOLLOWING should be of interest to everyone in the sand and gravel business who depends on a centrifugal pump as a source of supply:

(1) Take original packing gland and counter bore 1¼-in. deep, so as to allow for two extra rings of packing, to be used as a water seal to keep water from backing through and entering main bearing.

(2) Have an extra packing gland made to fit counter bore and shaft of original gland, to hold the two extra water-seal packing rings as shown in accompanying drawing. Just have this packing drawn up tight enough to keep from leaking water. You also have an oil hole in the original packing gland, used for either water or oil, that can be used for lubricating the two extra rings of packing.

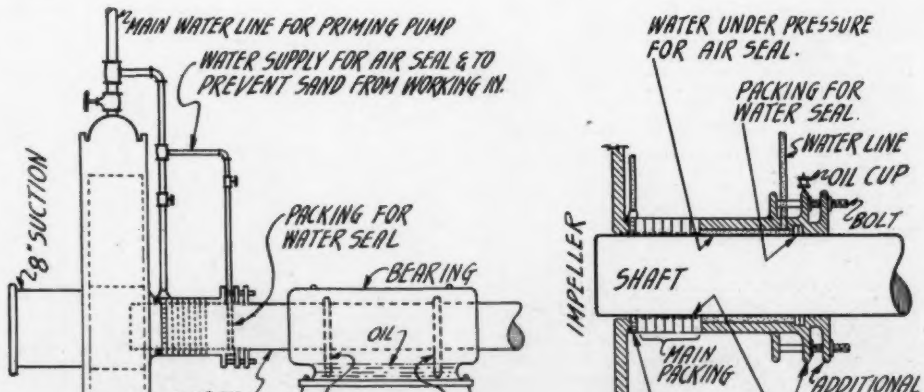
(3) Doing this you do away with a lot of water and grease that as a rule gets thrown all over the deck of the boat and acts as a stimulant in case of fire.

(4) Take the original packing gland, while counter boring, and have a ⅜-in. hole drilled in the body about 2 in. from flange, to enter your sealing water, which passes through between the shaft and gland, and then, if main packing isn't kept too tight, will pass through slowly between packing and shaft. This will keep sand from entering the main packing. This sometimes happens when you have an overload in the discharge, or if you are pumping against a high head and carrying over 70 lb. pressure on the discharge. As a rule, you have a suction on the shaft side of the pump as well as on the suction side, but not nearly so great, and when you get your line loaded so as to carry above 70 lb. pressure, you have a back pressure on the shaft side which will force sand back into your main packing, and then is when your shaft gets scored badly.

If the sand ever does enter into the packing, you had better take the packing out and replace it; if not, your packing being impregnated with sand will act as sandpaper gripped tightly around the shaft.

There is no reason why a shaft will not last indefinitely if the improved packing gland is installed. I am going into my third year now with one shaft, and it has not worn enough to notice, although we have worn out two impellers. The shaft looks good for several more seasons. I have repacked the pump twice since our pump has been in operation, and that was when changing impellers. I have been pumping sand now for 15 years and never had a shaft last for more than one impeller, and then the shaft was in very bad condition. And I also have had one shaft cut so badly that it broke while in operation.

This packing gland is economical.



Improved packing gland lengthens life of shaft

RECENT QUOTATIONS ON ROCK PRODUCTS SECURITIES

Stock	Date	Bid	Asked	
Allentown P. C., com.[47]	6-30-36	4	6	
Allentown P. C., pfd.[47]	6-30-36	7	9	
Alpha P. C., com	6-23-36	22¾	23¾	.25 (qu.) July 25
American Aggregates, com.[40]	6-15-36	⅝	1⅝	
American Aggregates, pfd.[40]	6-15-36	4	6	
American Aggregates, 6's 1st mtg. 3/6's, 1943, new bonds[48]	6-15-36	48	53	
American Aggregates, 6's, 1943, old bonds[48]	6-15-36	48	53	
Arundel Corp., com	6-24-36	17⅛	actual sale	.25 (qu.) July 1
Ashgrove L. & P. C., com.[47]	6-30-36	11	15	
Ashgrove L. & P. C., pfd.[47]	6-30-36	95	100	
Bessemer L. & C., Class A[47]	6-30-36	4½	5½	
Bessemer L. & C., 1st 6½'s, 1947[48]	6-15-36	82F		
Bessemer L. & C., cert. of dep., 1947[46]	6-13-36	81	84	
Boston S. & G., com.[37]	6-15-36	1	2	
Boston S. & G., new 7% pfd.[37]	6-15-36	8	10	
Boston S. & G., 7's, 1939[37]	6-15-36	70	....	
Calaveras Cement, com.[40]	6-15-36	4¼	5½	
Calaveras Cement, 7% pfd.[40]	6-15-36	83	87	1.00 (ac.) July 1
California Art Tile, A[9]	6-26-36	12	13	
California Art Tile, B[9]	6-13-36	1½	2	
Canada Cement, com.[42]	6-16-36	6⅝	6⅛	
Canada Cement, pfd.[42]	6-16-36	67½	68	
Canada Cement, 5½'s, 1947[42]	6-16-36	106	107	
Canada Crushed Stone, 6½'s, 1944[42]	6-16-36	92	....	
Certainteed Products, com	6-26-36	9⅛	9⅝	
Certainteed Products, pfd	6-26-36	88	88⅝	
Certainteed Products, 5½'s, A, 1948	6-26-36	92	actual sale	
Consol. Cement, 1st 6's, 1950[47]	6-30-36	77	79	
Consol. Cement, A[47]	6-30-36	4½	5	
Consol. Oka. S. & G., 6½'s, 1948[42]	6-16-36	10	15	
Consol. S. & G., pfd.[42]	6-16-36	31	....	
Consol. Rock Products, units[47]	6-30-36	60c	90c	
Construction Mat., com.[47]	6-30-36	10c	20c	
Construction Mat., pfd.[47]	6-30-36	⅛	1	
Consumers Rock & Gravel, 1st mtg. 6½'s, 1948[47]	6-30-36	29	31	
Coosa P. C., 1st 6's[47]	6-30-36	31	35	
Coplay Cement Mfg., pfd.[47]	6-30-36	11	15	
Coplay Cement Mfg., 6's, 1941[47]	6-30-36	90	95	
Cumberland P. C., 7's, 1937[47]	6-30-36	90	100	
Dewey P. C., com.[47]	6-30-36	45	50	
Dolese & Shepard[47]	6-30-36	34	36	
Dufferin Pav. & Cr. Stone, pfd.[42]	6-16-36	60	65	
Federal P. C., 6½'s, 1941[47]	6-30-33	45	50	
Fla. P. C., 6½'s, 1937[46]	6-13-36	100	101½	
Fla. P. C., units[47]	6-30-36	15	16	
Giant P. C., com[47]	6-30-36	3	4	
Giant P. C., pfd.[47]	6-30-36	16	19	
Gyp., Lime & Alabastine, Ltd.	6-26-36	6⅛	6¼	
Gyp., Lime & Alabastine, 5½'s, 1948[47]	6-16-36	96	98	
Hawkeye P. C., cap.[47]	6-30-36	30	35	
Hercules Cement, com.[47]	6-30-36	30	35	
Hercules Cement, pfd.[47]	6-30-36	80	90	
Hermitage Cement, com.[47]	6-30-36	15	20	
Hermitage Cement, pfd.[47]	6-30-36	96	98	
Ideal Cement, com.[47]	6-30-36	67½	70½	.50 (qu.) July 1 .25 (ex.) July 1
International Cement, com	6-26-36	47⅛	actual sale	.37½ (qu.) June 30
International Cement, conv. deb. 4's, 1945	6-26-36	134½	actual sale	
Kelley Island L. & T.	6-26-36	22	23	.20 (qu.) July 1
Ky. Cons. Stone, 6½'s, 1938[47]	6-30-36	16	18	
Ky. Cons. Stone, com.[47]	6-30-36	1	2	
Ky. Cons. Stone, pfd.[47]	6-30-36	3	5	
Ky. Cons. Stone, 1st mtg., 6½'s[46]	6-13-36	17	19	
Ky. Rock Asphalt, 6½'s, 1936[47]	6-30-36	20	25	
Lawrence P. C., com.[47]	6-30-36	17⅛	19	
Lawrence P. C., 5½'s, 1942[47]	6-30-36	98	100	
Lehigh P. C., com	6-26-36	18¼	18⅝	.25 Aug. 1
Lehigh P. C., 4% pfd	6-26-36	97½	actual sale	1.00 (init.) July 1
Louisville Cement[47]	6-22-36	90	....	
Lyman-Richey 1st 6's, 1935[47]	6-30-36	20	25	
Marbelite Corp., com. (cement pts.)[40]	6-15-36	25c	50c	
Marbelite Corp., pfd.[40]	6-15-36	4¼	4¾	
Marblehead Lime, 7's, 1944[14]	6-16-36	97½	98½	
Marquette Cement, com.[47]	6-30-36	28	30	
Marquette Cement, pfd.[47]	6-30-36	98	102	
Material Service Corp.[47]	6-30-36	7	8	
McCrady-Rodgers, com.[47]	6-30-36	5	6	
McCrady-Rodgers, 7% pfd.[47]	6-30-36	25	35	
Medusa P. C., com.[47]	6-26-36	15⅝	16	
Medusa P. C., pfd.[47]	6-30-36	45	50	
Michigan L. and C., com.[47]	6-30-36	40	45	
Minnesota Mining & Mfg. Co.	6-26-36	30½	31½	.25 (qu.) July 1 .05 (ex.) July 1
Missouri P. C.	6-26-36	11⅝	11⅝	
Monarch Cement, com.[47]	6-30-36	95	100	

Stock	Date	Bid	Asked	
Monolith P. C., com.[9]	6-13-36	3½	4	
Monolith P. C., 8% pfd.	6-13-36	6⅝	7	
Monolith P. C., units[9]	6-13-36	17	18	
Monolith P. C., 1st mtg., 6's[9]	6-13-36	101	103	
Monolith Portland Midwest, pfd.[9]	6-13-36	2¾	3¼	
National Gypsum, A, com.[47]	6-30-36	46	47	
National Gypsum, 1st pfd.[47]	6-30-36	102	103	1.75 (qu.) July 1
National Gypsum, 2nd pfd.[47]	6-30-36	15	16	.25 (qu.) July 1
National L. & S., 6½'s, 1941[47]	6-30-36	90	95	
Nazareth Cement, com.[47]	6-30-36	6	7	
Nazareth Cement, pfd.[47]	6-30-36	50	55	
Newaygo P. C., 7% cum. pfd.[47]	6-30-36	50	60	
New England Lime, units[14]	6-16-36	9	10	
N. Y. Trap Rock, 1st 6's, 1946	6-26-36	....	81	
N. Y. Trap Rock, 6's, stamped, 1946	6-26-36	82	actual sale	
N. Y. Trap Rock, 7% pfd.[46]	6-13-36	60	62	
North Amer. Cement, 1st 6½'s, 1953[47]	6-30-36	36	37	
North Amer. Cement, 6½'s, 1943[47]	6-30-36	92	94	
North Amer. Cement, 6½'s, 1940[47]	6-30-36	65	68	
North Amer. Cement, "A"[47]	6-30-36	1	2	
North American Cement "B"[47]	6-30-36	4	5	
North Shore Mat. 1st 6's[47]	6-30-36	40	45	
Northwestern P. C., units[9]	6-13-36	53	56	
Northwestern States P. C.[47]	6-16-36	22	24	.40 July 1
Ohio River S. & G., com	6-22-36	1	....	
Ohio River S. & G., 1st pfd	6-22-36	60	....	
Ohio River S. & G., 2nd pfd	6-22-36	4	....	
Ohio River S. & G., 6's[46]	6-13-36	10	13	
Oregon P. C., com.[47]	6-30-36	3	4	
Oregon P. C., pfd.[47]	6-30-36	92	95	
Oregon P. C., conv. pfd.[47]	6-30-36	60	65	
Pacific Coast Agg., new com.[40]	6-15-36	3¼	3½	
Pacific P. C., com.[40]	6-15-36	3¼	5	
Pacific P. C., pfd.[40]	6-15-36	44	47	
Peerless Cement, com.[47]	6-30-36	1	2	
Peerless Cement, pfd.[47]	6-30-36	8	10	
Penn.-Dixie Cement, com	6-26-36	6	actual sale	
Penn.-Dixie Cement, pfd. A	6-26-36	33⅛	35	
Penn.-Dixie Cement, 6's, 1941	6-26-36	95⅝	97	
Penn. Glass Sand Corp., com.[47]	6-30-36	18	20	
Penn. Glass Sand Corp., pfd.[47]	6-30-36	120	125	1.75 (qu.) July 1
Penn. Glass Sand Corp., 1st M 4½'s, 1960	6-26-36	105	105¾	
Petoskey P. C., 6's, 1941[48]	6-15-36	88	....	
Petoskey P. C., 6's, 1935-38[48]	6-15-36	95	....	
Petoskey P. C., com.[48]	6-15-36	3¼	4	
Republic P. C., 6's, 1943[47]	6-30-36	101	104	
Riverside Cement, A[9]	6-13-36	10½	12½	
Riverside Cement, B[9]	6-13-36	1¾	2½	
Riverside Cement, pfd.[9]	6-13-36	98	100	1.50 (qu.) Aug. 1
Rockland & Rockport Lime, 1st pfd.[47]	6-30-36	4	6	
Santa Cruz P. C., pfd.[9]	9-13-36	42	45	.50 July 1
Schumacher Wallboard, com.[9]	6-13-36	4½	5½	
Schumacher Wallboard, pfd.[9]	6-13-36	17	17½	
Signal Mt. P. C., units[47]	6-30-36	47	49	2.00 Aug. 15
Southwestern P. C., units[40]	6-15-36	105	....	
Spokane P. C., units[47]	6-30-36	10	12	
Standard Pav. & Mat. (Can.), com.[42]	6-16-36	2	2¼	
Standard Pav. & Mat., pfd.[42]	6-16-36	15	18	
Superior P. C., A[40]	6-15-36	33	36	.27½ July 1
Superior P. C., B[40]	6-15-36	10½	12	
Trinity P. C., units[47]	6-30-36	23	25	
U. S. Gypsum, com	6-26-36	96	98	.50 (qu.) July 1
U. S. Gypsum, pfd	6-26-36	164	164⅞	1.75 (qu.) July 1
Volunteer P. C., 1st 7's, 1942[47]	6-30-36	90	100	
Volunteer P. C., units[47]	6-30-36	3	5	
Vulcanite P. C., com.[47]	6-30-36	5	7	
Vulcanite P. C., 7½'s, 1943[47]	6-30-36	96	100	
Wabash P. C.[47]	6-30-36	9	10	
Warner Co., ww, 1st 6's, 1944[47]	6-30-36	69	71	
Warner Co., com.[47]	6-30-36	2	3	
Warner Co., pfd.[47]	6-30-36	8	10	
Whitehall Cement Mfg. com.[47]	6-30-36	40	43	
Whitehall Cement Mfg., pfd.[47]	6-30-36	47	50	
Wisconsin L. & C., 1st 6's, 1940[47]	6-30-36	75	80	
Wolverine P. C., com.[47]	6-30-36	5	6	
Yosemite P. C., A com.[40]	6-15-36	5	5½	

Quotations by: [9]A. E. White Co., San Francisco, Calif. [14]The Securities Co. of Milwaukee, Inc., Milwaukee, Wis. [37]Wise, Hobbs & Seaver, Inc., Boston. [40]Martin Judge, Jr., and Co., San Francisco, Calif. [42]Nesbitt, Thomson & Co., Toronto. [46]First National Bank of Chicago, Chicago, Ill. [47]Anderson Plotz and Co., Chicago, Ill. [48]Hewitt, Ladin & Co., New York, N. Y.

F = Flat.

Recent Dividends Announced

Alpha P.C., com. (quar.)	$0.25	July 25, 1936
Arundel Corp., com. (quar.)	.25	July 1, 1936
Coronet Phosphate	1.00	July 1, 1936
Idaho P. C., com	3.00	July 10, 1936
pfd. (semi-annual)	3.50	July 10, 1936
Ideal Cement, com. (quar.)	.50	July 1, 1936
(extra)	.25	July 1, 1936
Kelley Island L. & T. (quar.)	.20	July 1, 1936
Lehigh P.C., com	.25	Aug. 1, 1936
Minnesota Min. & Mfg. (quar.)	.25	July 1, 1936
(extra)	.05	July 1, 1936
Northwestern States P. C.	.40	July 1, 1936
Riverside Cement, pfd. (quar.)	1.50	Aug. 1, 1936
Santa Cruz Cement	.50	July 1, 1936
Signal Mt. P. C., pfd.	2.00	Aug. 15, 1936
(This leaves arrears of $62)		
Superior P.C., A (accum.)	.27½	July 1, 1936
(This leaves arrears of $3.02½)		

Pennsylvania Glass Sand Corp., Lewiston, Penn., and subsidiaries, report consolidated income of $96.836 before income taxes for the three months ended March 31. The company stated that its first quarter operations were affected by plant shutdowns and lack of transportation facilities due to floods and that $55,000 of estimated flood losses were charged direct to surplus. For the quarter ended March 31, 1935, the company reported net income of $104,496, equal to 19 cents a share on the common stock.

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Yosemite Portland Cement Corp., Merced, Calif., which last February notified its stockholders of a three months' postponement of its annual meeting, has again put the meeting off for three months until October. At that time stockholders will be presented a plan for recasting the capital of the company, clearing preferred dividend arrearages and putting the firm in a position to pay current dividends on the present class A 8% stock.

The independently audited annual report of the company shows net profit of $60,455 after all charges for the year ended December 31, 1935, compared with net loss of $39,423 for 1934. Preliminary reports in March showed a 1933 net of $54,361.

The company operated during 1935 at 34.39% of capacity, producing 334,265 bbl. of cement. In 1934 operations were at a 31.60% level. Profit for 1935 resulted from a 15% price increase, from the elimination of price-cutting conditions and from cheaper unit operating costs through larger production. Sales revenues for the year, although not stated in value, are reported at 25.7% higher than for 1934.

Recapitalization plans suggested by A. Emory Wishon, president, in his February letter to stockholders, have been delayed in formulation, he states in the annual report, because of inherent difficulties of reorganization and because of the illness of the company's attorney and of Mr. Wishon himself. By October he anticipates having a plan ready to submit to stockholders by which an indicated $1,700,000 preferred dividend accrual can be wiped out.

The independently audited balance sheet as of December 31, 1935, showing several points of difference from the preliminary statement published early in March, compares as follows:

ASSETS	1935	1934	1933
Cash	$289,620	$169,799	$106,083
Due on called bonds	63,000	......	......
Receivables, less reserve	128,447	100,649	157,943
Inventories	134,760	163,156	159,026
Total current assets	$615,827	$433,604	$423,052
Plant, property and equipment; net	1,259,244	1,340,188	1,406,746
Securities, at cost	258,934	276,541	280,681
Invest in real estate	22,728	31,753	32,088
Deferred charges	57,769	56,768	63,803
*Intangible assets	1,678,229	1,678,229	1,676,977
Total assets	$3,892,731	$3,817,007	$3,883,348
LIABILITIES			
Current liabilities	$48,744	$36,275	$50,108
Real estate liens	8,142	......	9,427
Class A stock: $10 par	2,214,510	2,214,510	2,223,510
Class B stock: $10 par	1,408,000	1,408,000	1,408,000
Earned surplus	213,335	158,222	192,302
Total Liabilities	$3,892,731	$3,817,007	$3,883,348

* Includes $1,408,000 set up to offset class B stock and $270,229 organization expense.

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Warner Co., Philadelphia, Penn., reports a consolidated income account for the year ending December 31, 1935, as follows:

	1935	1934
Net sales	$2,670,255	$2,737,684
Cost of sales	2,044,065	1,997,259
Depreciation and depletion	488,205	521,977
Selling expense	162,959	120,443
Administration and general expense	126,231	137,519
Provisions for bad debts	21,976	26,939
Discount allowed	92,237	98,783
Operating loss	265,417	165,236
Interest, dividends, etc., received	22,086	14,090
Discount earned	33,604	37,431
Loss	209,727	113,715
Bond and other interest	395,345	402,871
Amortization	36,777	36,882
Miscellaneous deductions	470	182
*Net loss	642,318	553,650
Earned per share, common	(d)$4.57	(d)$4.09

*Before surplus credits, 1935, $18,526; 1934, $38,919.

Note: Statement for 1935 and 1934 do not take into account estimated net profit of controlled companies not consolidated, which amounted to approximately $81,000 and $13,000 respectively.

Current assets, as of December 31, 1935, were reported $1,478,062, of which $850,956 was cash; current liabilities, $312,002.

Commenting on the condition of the construction industry in Philadelphia and vicinity, past and present, President Charles Warner said:

"The forecast for the construction industry in the territory contiguous to the Delaware River for 1936 is more encouraging, as evidenced by a substantial increase in contracts on hand and a growth of confidence and appreciation of long deferred needs in this direction. The new Philadelphia City Administration, also, is adopting a broad and constructive policy towards much needed public improvements. However, as long as the national political uncertainty continues, construction expansion is not likely to return to the full normal volume of the past decade.

"That our security holders may understand the tremendous variations in construction volume in our major market, the City of Philadelphia, during the past fifteen years, we present the following brief figures. According to the F. W. Dodge Corp. statistical reports, the total construction volume in Philadelphia, public and private (small jobs not accounted for), during the decade ended 1930 averaged $152,000,000 per annum. This period included the low years of recovery following the first postwar depression of 1920 and also the two boom years of 1927 and 1928. During the four years from 1932 to 1935, inclusive, the total construction in Philadelphia (public and private) averaged less than $20,000,000 per annum. This study indicates that during the past four years a considerable deficiency in construction in the City of Philadelphia has accumulated, which view is generally supported by several recent studies made by public and private bodies. The above study also indicates the greater extent to which the Philadelphia district has suffered in decreased construction activity during the past four years as compared with the average throughout the United States, since the Dodge reports show that the national volume amounted to about 25% of that experienced during the preceding decade, while Philadelphia volume dropped below 15%.

"With a reasonable clearing up of national political uncertainties and a continuation of the present ease in the money market, it would appear that your company may look forward with confidence to the future."

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Boston Sand and Gravel Co., Boston, Mass., reports for the years ended December 31:

	1935	1934
Gross earnings	$809,328	$854,943
Operating expenses and taxes	753.772	757,769
Depreciation	69,690	77,012
Depletion	5,596	6,471
Operating income	(d)19,730	13,691
Interest	26,311	27,827
Net loss	46.041	14.136
Earned per share, com.	(d)$2.15	(d)$1.52

As of December 31, 1935, current assets were $305,441 and current liabilities $28,704

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New England Lime Co., Adams, Mass., reports sales and earnings for the period April 17 to December 31, 1935, as follows: Net sales, $298,279; net profit after depreciation, depletion, federal taxes, etc., $15,592. Current assets (cash, $57,904) were $151,321 and current liabilities $61,038.

S. Walter Stauffer

ALL Angles of LIME Discussed at Industry Convention

Henry LaLiberte

WHAT was lacking in numbers was made up in earnest, serious enthusiasm at the annual convention of the National Lime Association, Hot Springs, Va., June 3 and 4. Like other industrial associations which had leaned heavily on the National Industrial Recovery Act, the sudden withdrawal of quasi-governmental support left the lime industry somewhat bewildered.

Prior to the convention the board of directors had appointed a committee to study a possible reorganization of the association along the lines of making the national association activities more or less subordinate to those of district groups. Their conclusions were that a national association in name only would be totally ineffective; that the logical location for the headquarters office is in Washington, D. C., as it is now; that the present organization is along sound lines and that what is needed is not a reorganization but a greater development of activities now in hand and any change in the general method of conducting the present organization may result in impeding, rather than enlarging, the scope of the progress of the industry. The committee reported that if the membership will make greater use of the technical services, the information which has been developed by the National, and all other facilities which are available, they could then produce maximum results.

This report was adopted unanimously, and the members adopted a budget which will make possible continuance of the association as now constituted. This calls for dues of 6c per ton of lime products.

Officers

Henry LaLiberte, president, Cutler-Magner Co., Duluth, Minn., was elected chairman of the board of directors. The board then selected the following officers:

S. Walter Stauffer, president and general manager; W. V. Brumbaugh, secretary and assistant treasurer; Ralph P. Wilton, treasurer, Steacy & Wilton Co., Wrightsville, Penn.; Miss Roma F. Medford, assistant secretary.

S. Walter Stauffer, the new president and general manager, is the natural successor of Norman G. Hough, who recently resigned to become general sales manager of the Kelley Island Lime and Transport Co. Mr. Stauffer, as a producer, had been chairman of the board of directors, and not only knows the lime industry but, of course, was very intimately acquainted with the work and personnel of the association. His remarks as acting president and president were brief but pointed.

Industrial Uses of Lime

The program included three papers on industrial uses of lime by outstanding experts in each field.

Sewage Treatment

W. A. Hardenbergh, vice-president and editor of *Public Works Magazine,* New York City, in a paper, "Lime in the Treatment of Sewage and Industrial Wastes," said in part:

With the increased activity in the chemical treatment of sewage, lime promises to assume almost as important a place in that field as it now does in water treatment. For instance, of 23 basically important United States patents relating to chemical treatment of sewage which were dated in the five years 1931 to 1935, inclusive, the use of lime was clearly included in eleven, while in several others it must or can be used. Likewise of 13 patents granted in recent years for chemical processes in sewage treatment, 10 include lime as an essential element in the process of treatment.

These patents relate principally to coagulation. In addition, lime is used frequently in sludge digestion tanks to correct acid conditions; occasionally in conditioning a sludge for final treatment before dewatering; and also on sludge drying beds to prevent or minimize odor.

In the treatment of industrial wastes, lime is almost universally used, generally in connection with other chemicals.

Mr. Hardenbergh then summarized briefly the history of sewage treatment, first the use of chemicals, later the trend toward biological methods, and more recently a trend to return to chemical treatment, which includes, of course, the use of lime. He continued:

Chemical Treatment

The degree of treatment obtained by using chemical precipitation is not so good as that secured by the use of secondary treatment devices, such as trickling filters, or by the use of the activated sludge method of treatment, but it is better than that obtained by sedimentation alone, and may frequently be all that is required.

Chemicals are of especial value in caring for plant overloads and in affording economically an added degree of treatment during periods when there are low water flows in diluting streams. The use of chemicals may also permit a considerably increased rate of operation of secondary treatment devices.

In other words, chemical precipitation considerably extends the field of use of tank treatment and permits existing methods to be used more effectively and over a wider range of conditions. Where the highest degree of treatment, such as that by activated sludge, trickling filters or sand beds, is not required, but better results are necessary, during a portion of the year, than are obtainable from simple sedimentation, such results can generally be obtained by chemical treatment. The costs of construction for such treatment are but slightly in excess of those for simple sedimentation, and operating costs are also reasonable.

Methods of Use

The method used is generally the same as that employed in water treatment plants,

in that the chemical is added to the sewage, forming a gelatinous precipitate or floc, which settles to the bottom, sweeping down with it much of the suspended and some of the colloidal matters in the sewage. Settling tanks follow the usual design for plain sedimentation tanks. Apart from the provision for thorough chemical mixing—which is important—there are no material changes necessary in designing the modern type of settling tank provided with sludge removal apparatus. A plant designed for sedimentation may be changed over to chemical treatment with practically no cost except for mixing equipment.

* * * * * *

Processes Involving Lime

Most of the work to date in sewage treatment has employed iron salts for coagulation, after dosing with lime to obtain pH values suitable for coagulation.

Copperas, or ferrous sulphate cannot, as a rule, be used alone; lime must be added. The end result is a ferric hydroxide—the desired floc. In this process, lime is first added to the sewage, generally in excess of the amount required to complete the theoretical chemical reaction to raise the pH—a necessary condition for good floc formation. The excess lime acts as an additional clarifying agent.

The same general reactions, resulting in the formation of ferric hydroxide, are obtained by the use of lime with other iron salts, including ferric sulphate, chlorinated copperas, ferric chloride and ferrous chloride. In all of these, the lime is added first, and when the pH has been raised sufficiently, the iron salt is added and mixed by means of flocculators or blowers.

Since alum coagulates at a low pH, that is, on the acid side, lime is infrequently employed in connection with alum as a precipitate; but since the result of using alum is to produce an acid sludge, lime may be needed to correct the acidity of the sludge in order to improve subsequent digestion. As yet alum has been used in very few treatment plants. At Liberty, N. Y., black-alum (a mixture of alum and activated carbon) was used during most of the summer of 1935 and gave excellent results. The manufacturers of alum have become interested in this field and further developments may be expected.

Lime alone may be used as a precipitant, combining with the carbonic acid present to produce calcium carbonate, which is the desired coagulant. Much more lime is required than when used in connection with iron salts, but too much lime may cause the formation of caustic calcium hydroxide, the breaking down of particles of organic matter, and the production of an unsatisfactory effluent.

Proprietary Processes

There are a number of proprietary or patented processes which for the most part employ iron salts and lime in connection with special devices, or through the addition of inert materials.

Laughlin employs ferric chloride and lime for coagulation, and at times adds paper pulp. Originally the spent lime from acetylene manufacture was used, but this is not always available and commercial lime is then purchased. This process makes use of sedimentation, followed by upward filtration through crushed magnetite. At Dearborn, Mich., where operating results are available covering two years or more, from 150 to 350 lb. of lime per million gallons of sewage were used. In preliminary work at the Perth Amboy, N. J., plant lime dosages have averaged around 600 lb. per million gallons of sewage.

Streander employs ferrous sulphate and lime, with air, and follows with sedimentation and filtration. The usual lime dosage is about 400 lb. per million gallons.

Other processes include the Putnam, Guggenheim, Diamond Alkali, Travers and Lewis. All of these include lime as a more or less important part of the process.

Lime Dosages

The strength and character of the sewage and the particular chemical used for coagulation are important factors in the amount of lime used. At Liberty, when using iron salts, about 800 lb. of lime per million gallons of sewage were used, that is, 800 lb. per day. This is a higher dose than is ordinarily needed, as the sewage being treated was very much stronger than will be found in most communities. It is likely that sewage plants will generally use 400 or 500 lb. of lime per million gallons. For a city of 25,000 population, with a flow of 3,500,000 gallons of sewage per day, the amount of lime used would aggregate three-quarters of a ton daily.

Other Uses of Lime

A most important usage of lime in sewage treatment is for correcting acid conditions in the sludge or in the sewage. Lime may be added to the incoming sewage, but more often it is added to sludge digestion tanks or to the sludge chambers of Imhoff tanks to correct acidity and improve digestion. Dosages of lime for this work vary greatly, depending largely upon local conditions.

At Dayton, Ohio, lime has been used in combination with chlorine to improve Imhoff tank operation, and also for odor control. Dosage was about 100 lb. per million gallons.

In a few places the addition of lime to aid in vacuum filtration of sludge has shown good results. The necessity or desirability of its use is affected by local conditions. Iron salts or alum are more generally used in this work, but lime may make possible a reduction in the use of the costlier chemicals.

Industrial Waste Treatment

Lime has a place in the treatment of almost every type of industrial waste.

Cannery Wastes—The wastes resulting from canning and processing peas, beans, corn, carrots, beets and sauer kraut are in general the same in that these wastes carry much suspended vegetable matter and are highly acid. The method of treatment most often used is fine screening to remove as much as possible of the fibrous vegetable matter, followed by the addition of chemicals and settling, sometimes with final treatment on trickling filters. Ferric chloride, copperas and alum have been used, all of them in combination with lime. Dosages vary, of course, but about 3 tons of lime are usually required per million gallons of waste.

Creamery and Milk Wastes—Iron salts and lime are also used in milk and creamery waste treatment. Trickling filters and the activated sludge method have also yielded good results with these wastes, but when these methods are used, the addition of lime may be beneficial.

Textile Wastes — The wastes from scouring, bleaching, dyeing and other textile processes vary greatly in strength and composition, so that any fixed rule for treatment is impossible. In general, the use of copperas or ferrous sulphate and lime will produce satisfactory results, but relatively large quantities will be needed.

Laundry Wastes—These highly alkaline wastes are among the most difficult of the industrial wastes to treat. Iron and lime, or acid and alum are used. Heavy dosages are necessary. Daniels used 16 pounds of lime per 1000 gallons of waste.

Packing Plant Waste—The copperas and lime combination fits well into packing waste treatment, though other methods are also used.

This brief resumé of the uses of lime in the treatment of some of the more common industrial wastes is illustrative of its value and all-around usefulness in the field.

Trend Toward Chemical Treatment

Chemical treatment has excited a vast interest and its many undoubted advantages indicate that it will be an important method of treatment in the future. Reasons for this include the following: Chemical treatment is useful in connection with almost every other process and can be employed to supplement many present-day methods. First costs are reasonable, and so are operation costs.

Various surveys have indicated that there are about 3500 sewage treatment plants in the country. Of these perhaps 1000 are large enough and modern enough to utilize chemical treatment, if so desired, and many of the others will find the use of lime and certain other chemicals advantageous from time to time to meet various operating conditions.

According to the report of the American Public Health Association committee, there were 35 plants using chemical precipitation in 1935; 9 plants were under construction; and 23 others were planned. Most of the plants now being built even though not planned especially for chemical treatment are of such type that they are adaptable to it and are built with a view to its possible use in the future.

An unfortunate condition in the sanitary engineering field is that the various engineering departments of our states, with a very few exceptions, do not have any facilities for research and development work in sewage treatment. As a result, the burden of development of equipment, materials and methods falls very largely upon industry. Thus the progress in sanitation is about as much dependent upon sales ability as on mechanical or chemical ingenuity, or perhaps even more.

It is not possible therefore, for any section of the industry, to hope that sales will develop without effort. This is true of the lime industry even though, at present, lime appears to be an essential in many processes. The development in the use of iron salts has opened a considerable potential market for lime; yet a similar development of the use of acid and alum might close this market to a large extent.

The avenues through which such developments can best be made are not well established. Demonstration work, research, publicity and coöperation all have a part. At this time, when no single method of use is well established, when the interest in chemical treatment is so great that mere suggestions are eagerly tried out, and when it is difficult for the average engineer to get complete data, the first step might well be the furnishing of exact information on results that have been obtained by the various methods. Of course, such data should be prepared by, and from the viewpoint of, sanitary engineers, chemists and other technical men.

Chemical treatment is so far only an infant, even though a vociferous and husky one. Any campaign to develop a market for

lime, or for any other product, must provide a lot of emphasis in helping this infant to grow, and to grow on safe, sound, and conservative lines.

Water Supply Treatment

Charles P. Hoover, chemist in charge of the water softening and purification works, Columbus, Ohio, speaking on "The Development and Treatment of Water Supplies," first reviewed in a very interesting manner the nature and importance of water (H_2O).

Having thus discussed "the biggest subject in all creation," Mr. Hoover turned to the subject of water purification. He illustrated by maps the states in the union where water supplies need treatment, the location of treatment plants in Ohio, where much progress has been made, concluding as follows:

Lime has two products to compete with in softening and treatment to prevent corrosion; namely, zeolite and soda ash. Soda ash costs more than lime and is not applicable to the treatment of all water supplies because water to be non-corrosive in distribution systems and hot water tanks must have enough calcium in it to produce solubility equilibrium to calcium carbonate. All supplies do not have enough calcium for this and soda ash does not, of course, supply any calcium ions. Soda ash has the advantage, however, of not increasing the hardness of water treated, whereas lime added in quantities just sufficient to prevent corrosion does increase hardness, and for this reason soda ash is sometimes used in preference to lime. That is where it is applicable.

Lime treatment has advantages over zeolite for softening if the hardness is due to carbonates, and in many supplies the carbonates predominate. Lime eliminates carbonate hardness more cheaply than zeolite and at the same time removes objectionable iron compounds whether in solution or suspension. Also the hardness compounds are removed and not simply changed to equivalent amounts of sodium compounds.

(Mr. Hoover concluded his remarks by experimental demonstrations of the function of lime in the treatment of water.)

Paper Manufacture

John Traquair, director of research, Mead Corporation, Chillicothe, Ohio (paper manufacturers) on the subject, "The Lime Requirements of the Paper Industry," said in part:

Lime is used in the paper industry as a chemical reagent at quite a number of points. The list includes:

(1) Rag boiling.
(2) Cooking of straw for strawboard.
(3) Manufacture of bleach liquor.
(4) Causticizing of leach liquor for the soda and sulfate processes.
(5) Manufacture of sulfite pulp and some high alpha pulps.
(6) Manufacture of coating colors such as satin white.
(7) Manufacture of calcium carbonate for coating and filler.
(8) Auxiliary processes such as water softening, effluent purification, etc.

For each purpose the lime used has to have special characteristics. A lime may make an excellent mortar but be of little value for making paper filler. Lime varies with the variations in the limestone and the burning process, and limestones vary with that wide prodigality of variations inherent in all natural products.

The quantity of lime used per ton of pulp or paper produced varies according to the process used, the soda process being the largest consumer, using around one-half ton of lime per ton of pulp. The Mead Corporation being a large producer of soda pulp uses 100 tons per day of bulk lime: 45 tons of dolomitic and 15 tons of high calcium lime at Chillicothe, and 40 tons of high calcium lime at Kingsport, Tenn. Naturally, at Chillicothe, we get our lime mainly from the lime producing northwestern corner of Ohio.

I might go over briefly the various uses, and then deal mainly with the newer use of calcium carbonate as a filler in paper, as this accounts for a considerable increase in the use of lime products in the paper industry.

Rags

The use of lime in boiling of rags dates back to the early history of paper making. The boiling of rags with lime of course was copied directly from the textile industry, where lime was used to boil cotton cloth to saponify the waxes and clean the cloth to prepare it for bleaching, printing and finishing. However, lime is being displaced by alkalies such as sodium carbonate and caustic soda, generally with a view of cutting down the time of operation and yielding a more thoroughly purified product. For certain grades of rags lime is still the favorite chemical.

Strawboard

This is also one of the ancient uses of lime. At one time large quantities of straw went into the manufacture of newsprint and other papers, straw and rags being the main paper-making raw material. With the advent of the sulfite and other more modern processes utilizing wood, straw paper tonnage declined and now the main use of this material is for corrugating board and strawboard.

In the strawboard process the straw is cooked in rotary digesters with about 10% of lime, as a milk of lime. The cooking time is usually 8-10 hours at 40-50 lb. steam pressure. The cooked straw is dumped and sometimes allowed to age for at least 24 hours. In the more modern mills it is fed to breaker beaters where it is broken up and discharged continuously through a perforated backfall, the thickened stock then being fed to the regular beaters where it is reduced to relatively fine fibers, washed and fed to the board machine generally with additional jordan treatment.

Many attempts have been made to displace lime with other products; caustic soda gives a much stronger pulp, but the stock is very slow and so schemes have been devised whereby every second digester is cooked with caustic soda and the board was made from a 50-50 mixture of lime cooked and soda cooked pulp. Extensive tests have been made substituting part of the lime with compounds such as soda ash, caustic soda, sodium sulfite and sodium sulfide; possibly caustic soda and sodium sulfide are the most efficient, but as strawboard is a low cost commodity the cost of these newer chemicals is always distinctly higher than the old lime process, although a smaller percentage of the newer reagents is required.

Sulfite Process

As a matter of fact lime is now seldom used to make up calcium bisulfite liquor. In most of the modern mills the sulfur dioxide gas from the sulfur burners, after cooling, is forced up tall towers packed with limestone and down which water is trickling. The limestone functions in absorbing and combining with the SO_2 to form soluble calcium bisulfite. The water and SO_2 supply are adjusted to give liquors of definite strength usually about 5-6% SO_2 content, 1 to 1½% combined, 3 to 4½% free SO_2. Thus it is only in the manufacture of bleach that lime comes into the picture in this particular section of the paper industry, although processes are in use where the partly bleached pulp is boiled with about 90-100 lb. of lime per ton as part of the bleaching and purification process in the manufacture of certain grades of pulp to be used in the making of rayon.

Bleach Making

Up to the War days nearly every manufacturer bought his bleach as bleaching powder containing 33-35% active chlorine. These days are long past and now all the large manufacturers buy the lime as bulk lime or hydrate, and the chlorine in tank cars or one-ton containers.

Lime requirements for bleach making are: that the lime should have a high per cent of available CaO, and a low but fast settling sludge. Most of the large users have now erected special plants to make their bleach liquor, and this generally consists of large deep tanks with a high speed stirrer, the slaked lime being made up separately and pumped into the tank, and then the chlorine gas is fed in near the periphery of the propeller which breaks it up into a large number of minute bubbles which are easily absorbed by the lime. It is important in bleach making that the lime liquor is not over-chlorinated as this tends to the production of chlorate and rapid deterioration of chlorine availability in the bleach liquor.

In many cases makeshift equipment was used at first. I can well remember when we changed over from bleaching powder to chlorine and lime. We erected an absorbing tower down which the lime liquor was circulated, until it was chlorinated sufficiently, which was judged by the phenolphthalein reaction. We had to use our old bleach making tanks for settlement and we were short of accommodation so had to have a fast settling lime with low sludge. I remember at that time after testing several limes we went to a very pure lime hydrate. This cost us more than some other limes but it enabled us to use our plant and run quite a number of batches before we had to finally settle out the sludge, wash it and dump it to the sewer. Here an economy in lime was secondary to a lime that would operate in the old plant. With increased accommodations in a new plant we do not need to hurry things, and, therefore, pay a great deal more attention to the cost of lime and some of its other qualities.

These last few years have seen additional changes. Bleaching is a rather slow process, that is using straight hypochlorite bleach the time of contact between it and the pulp must be at least 4-6 hours for complete exhaustion. It was known, however, that the action of chlorine gas was extremely rapid and so most pulp manufacturers after they had obtained some experience in handling chlorine gas introduced the chlorine directly into the pulp where the reaction took place in a few minutes instead of hours. Then sufficient milk of lime is added to absorb any excess chlorine and render the whole batch alkaline. The pulp is washed to remove the by-products of the bleaching reaction and then given a further bleaching with weak hypochlorite. It was found that about 25% of the total chlorine requirements could be saved by splitting the bleaching process into a number of steps. It had

been previously shown that a saving in bleach and a better product was obtained with straight hypochlorite bleaching if the bleaching was effected in multiple steps instead of in one step, and a further improvement was found to be effected by using the chlorine first, then enough lime to neutralize and effect the solution of some of the chlorinated impurities and remove them from the scene of action by washing out.

These bleaching processes, however, are still undergoing changes, the tendency being to substitute caustic soda in place of lime, the reason being that the lime forms sparingly soluble compounds with the chlorinated lignin and is not so easily washed out, and greater purification is obtained by the use of caustic soda. Chlorinated lignin behaves like a soap, and hard water or lime makes washing less efficient. For hard bleaching pulps (and we are now bleaching pulps such as kraft which years ago was considered an impossibility), it has been found that the more steps in the process the better the product, both as a color and quality.

Carbonate Filler

We now come to the most modern use of lime, namely as a filler in paper. Some sixteen years ago when I first became connected with The Mead Corp. I was impressed by the fact that all our waste lime sludge from the causticizing plant was being dumped to the sewer, and at that time it amounted to over 30 tons per day. It was fairly evident that if our processes could be revamped to produce a clear, clean leach liquor and a good lime used, the lime sludge produced would be suitable for use as a filler in paper, and would be more economical than the English clay which we were then using. I knew the problem had many angles and was by no means a simple one, but did not realize that several years would elapse before the problem would be solved to a sufficient extent so that we would actually make paper on the paper making machine.

The whole history and background of this development was reviewed in the recent Rafton vs. Castanea suit which was tried in the Federal Circuit Court at Pittsburgh before Judge Schoonmaker, January 6-16, 1936, Equity 2815. The decision rendered recently declared invalid all the Rafton claims in suit, but is subject to an appeal.

The Raffold process used dolomitic lime. Previous to the time lime sludge was developed as a potential paper filling material, the requirements of a good lime for causticizing leach liquor were:

1. High available CaO.
2. Quick settling of resulting carbonate, easily washed by decantation.

Dolomitic lime was considered useless as:

1. Low available CaO.—Magnesia had no causticizing effect.
2. Fine, slow settling precipitate—difficult to handle and wash.

When the possibility of using lime sludge as a filler in paper came into the picture dolomitic lime had the desired qualities and the introduction of rotary vacuum filters made the process practical.

Another fact was that the Mead Corp. was a large manufacturer of book or magazine paper and had found (1) that it was not necessary for this type of paper to be rosin sized, and had operated for several years making a practically unsized paper, and (2) we realized that a carbonate filler would give a brighter color, greater opacity and a better and more ink-receptive printing surface. These possibilities constituted the urge to utilize our waste lime sludge as a filler in paper; added to this was (1) the saving which was considerable, and (2) the elimination of another waste disposal and stream pollution problem. Thus coöperative development was undertaken; but it was 1928 before the Mead Corp. was producing carbonate filled paper on a large scale.

It should be noted that carbonate filler had been used for many years in certain special papers such as thin Bible papers, cigarette papers, etc.; but these constitute only a very small fraction of the total papers produced. The Mead Corp. on the other hand is a large producer of book and magazine paper with a yearly production of well over 50,000 tons at Chillicothe.

This rather revolutionary step had many repercussions in the industry; the superiority of the paper for high speed printing was soon apparent and the demand for this type of paper gradually became quite insistent among magazine publishers, etc. A somewhat less satisfactory phase, however, was the utilization of the waste paper. The trimmings and waste magazines which came back in the waste paper industry for remanufacture into paper and board did not de-ink very well by the standard process, and if used in a paper to be sized were highly deleterious to the sizing, thus the de-inking process had to be changed somewhat, and if the de-inked papers had to be used in a paper finish which was being sized they had to receive special treatment such as washing or souring to remove the carbonate.

The advantages of carbonate of lime in book papers has lead to an increasing use of specially precipitated calcium carbonate by paper manufacturers who did not produce their own soda pulp, and so today calcium carbonate is being produced by precipitation of milk of lime with CO_2 specifically for paper filler and paper coating.

Other precipitated lime salts have been patented such as calcium sulfite which is produced by precipitating lime with SO_2; its use, however, is confined to one company.

Regarding the manufacture of filler for paper, the leach liquor, sodium carbonate, from the black ash or Wagner furnace is first filtered through a Sweetland filter using soda pulp as the filtering medium to thoroughly clarify it and remove all insoluble impurities. The actual boiling takes place in two steps although theoretically the same object could be accomplished in one step, as in the old process. In the first step an excess of slaked lime is used so as to produce high causticity liquor at least 90% and over. When the reaction is complete the batch is pumped over an Oliver filter and the precipitate washed on the filter with wash liquor from the second boiling. The cake is made down in this weak liquor and screened through a 150-mesh Hummer screen to remove dirt and grit. The screened slurry now receives a second boiling with excess sodium carbonate, generally most of the make-up soda ash is used at this point. This thoroughly carbonates all the lime so that there is no free lime present. The cake is now well washed with water on an Oliver filter, and the washed cake made down in water and pumped to storage tanks where it is circulated to the paper machines as a milk at a consistency of around 2.5 lb. per gallon.

A few pounds of alum are sometimes added per batch to neutralize traces of free alkali.

In the old causticizing process it was desirable to have a quick settling large particle size precipitate, but in the new process a fine precipitate with small particle size is preferable. This is true for all pigments where covering power and opacity are required. A great deal of experimentation has been done during the last few years on methods of slaking the lime, and generally conducting the process so that we could control the particle size to meet our requirements. We are using a soft burned lime and water slaking, and the particle size is tested by an empirical test for settling rate. Owing to the natural variations in lime we are still unable to decide except by a practical test whether a lime is suitable for our purpose or not. The comparative test we use is the simple one of shaking up 50 grams of the product with a liter of water in a graduate and noting the amount of settlement by reading the number of ccs. of clear liquid after 5, 10 and 15 minutes, and also the compacting volume after 30 minutes.

Paper Machine Operation

The use of carbonate fillers in paper we found was not the simple one of replacing so many pounds of clay with so many pounds of carbonate, in fact it is generally true that the use of new products raises a number of unexpected problems.

Owing to the recent litigation, the final outcome of which is still uncertain, I would prefer at this time not to deal with the history of the application of alkaline fillers to paper making practice; moreover, I believe that details of these methods of using alkaline fillers in paper would not be particularly interesting to a group of lime manufacturers.

Carbonate as a Paper Coating Pigment

Precipitated calcium carbonate has been made for many years and used in quite a number of industries, perhaps toothpaste is the most familiar.

Satin White made by mixing slaked lime and alum under very definite conditions has been used as a paper coating material where high gloss is desired for many years, but has suffered from the disadvantage that it had to be marketed in the form of a paste containing about 66% water.

Calcium carbonate, owing to its cheapness, whiteness and good printing quality has been steadily increasing in favor as a paper coating material. Usually this is made by passing CO_2, either from purified stack gases or from a coke furnace or other available source, through milk of lime. The process is somewhat slow as the rate of carbonation decreases towards the end point.

Numberless methods have been suggested to control the particle size, but the newer method is to take normal precipitated carbonate and mechanically reduce the particle size by pebble milling or treatment in a colloid mill. These methods decrease the particle size by breaking down the aggregates and give a smoother and more opaque coating. Other things being equal the opacity of a pigment is influenced to a certain extent by its particle size.

Paper coating is a large subject and the varieties of paper made almost innumerable, and so the general character of carbonate is modified to suit the use requirements.

Recently, coating methods on the actual paper making machine have been developed to improve the printing quality of paper, especially for illustrated magazines. If this develops it will mean a large potential market for carbonate fillers.

Operating Problems

One entire session dealt particularly with problems of operation and manufacture. This was not so complete as some had hoped for, but an excellent beginning was

made toward a return to "operating men's" discussions, which were one of the most interesting and instructive features of lime industry conventions of several years ago.

Safety

Paul Hatmaker, of the National Lime Association staff, speaking on "Accrued Dividends from the Lime Industry Safety Competition" said in part:

Two years ago, we undertook a preliminary survey of the accident situation in the lime industry, and we made three important findings: first, that our accident rate was far too high; second, that the trend from 1931 through 1933 was upward; and third, that the cost of compensation insurance generally was of the order of two to three dollars per hundred dollars of pay roll higher than it should be.

We found some companies with excellent safety records and others where no particular safety program ever had been inaugurated. High accident rates were not confined to any particular size group, nor to specific localities. It simply was a question as to whether or not the management had become sold on safety work and had in turn sold the organization.

Our immediate responsibility obviously was to bring the facts to the attention of the members of the industry with the objective of reversing the rising accident rate and ultimately establishing a minimum level which would yield dividends to employes and employers alike.

A greater number of companies, in due course, became interested in the possibilities of accident prevention work, and some excellent individual results have been achieved. We have been glad to be of such help as we could to those who have called upon us for assistance, and the Association is acting as a clearing house of information pertaining to safety in connection with lime manufacture.

As a result of the increased interest in safety, the industry has already checked the rising trend of accident rates which was so alarming two years ago. The accident frequency rate was decreased 20% in 1934 over 1933, and approximately 16% in 1935 over 1934, although complete figures for the entire industry are not available for 1935. A frequency rate, as you know, is the number of lost-time injuries per million man-hours of exposure.

However, as a whole our industry still has at least five times the number of accidents it should have, judging by the accomplishments of those who have carried on a safety program over a considerable number of years.

Many of the plants that were entered in the Association's contest for 1935 achieved splendid results. For the six months period of the initial competition, the contestants had an accident frequency rate of 28.6, which represents a reduction of 26% for those plants over 1934.

Now, a word as to the direct cost of accidents. We estimate from National Safety Council data that the average cost of an accident is $435 to the company and the employes, which figure includes fatalities and permanent disabilities as well as minor injuries, and covers wage loss, medical expense, and overhead cost of insurance. Data from three different angles check substantially this figure. On this basis, the activity during the past two years already points to an annual saving to the industry of $146,000.

Lime plants and quarries *can* be operated safely. Of course, the head of the company must be sold on safety work, and his enthusiasm must seep down through the organization even to the newest and greenest man on the pay roll. The plant must be made safe mechanically through adequate guards, proper manways, and well maintained steps, treads, and the like. Good housekeeping must prevail at all times. The men must be trained to work safely, and each man should be instructed in first aid. Responsibility for those things must lie squarely upon the foreman and the superintendent. Interest in safety must be carefully built up and maintained. Ways and means include entering your plant in the Association's annual competition. Monthly interdepartmental contests at the plant, with perhaps nominal monetary bonuses to the men in the winning units, have shown their worth. We recently published in our monthly Safety Letter one such plan which has achieved eminently successful results.

Why should we continue to waste hundreds of thousands of dollars a year in our industry through unnecessary injuries? If every principal lime manufacturer would get solidly behind a safety program for his plant, we could double the general sales promotional activities of the industry and pay for it out of savings in accident costs, leaving a substantial operating profit left over besides. I make that statement with no mental reservations whatsoever, and offer it as a challenge to the business judgment of the management of the lime industry. And what is even more important, human lives will be saved, permanent disabilities will be fewer, suffering will be lessened, more homes will be intact, employes' earnings will be more stable, industrial relations will be improved, and we all will have the satisfaction of having helped do a most worthwhile job.

Now, I have an announcement to make. The following lime plants of the companies named went through the period of the contest from July 1 to December 31, 1935, with no lost-time accidents. To the employes and to the management, we offer congratulations upon their splendid achievement:

The York, Penn., plant of the National Gypsum Co.

The Galloway, Mo., plant of the Ash Grove Lime & Portland Cement Co.

The Berkeley, W. Va., plant of the North American Cement Corp.

The Mitchell, Ind., plant of the Lehigh Lime Co.

The South Chicago, Ill., plant of the Marblehead Lime Co.

The McCoy, Penn., plant of the Warner Co.

The Thomasville, Penn., plant of the J. E. Baker Co.

The Newala, Ala., plant of the Newala Lime Works.

The Quincy, Ill., plant of the Marblehead Lime Co.

Open Pit to Mining

J. R. Thoenen, senior mining engineer, U. S. Bureau of Mines, Washington, D. C., who has familiarized himself with limestone mining in every part of the United States, spoke on "The Transition from Open Pit to Underground Mining of Limestone," in part as follows:

Transition means change or conversion and while many limestone quarries have been so changed or converted, and many others can be, there is a much larger number that will never pass through such a transition stage. Under these circumstances the open pit quarry operator is justified in asking, "Why and when should such a change be made?"

The answer to these questions must be determined by local conditions at each separate quarry. A cause sufficient to require the change at one location may be inadequate at another; likewise two quarries operating under somewhat similar conditions may have entirely different factors justifying a change from surface to underground mining. The answer for any particular location must be found in a searching consideration of (1) the causes warranting the change; (2) the change in operation involved in a transition from one method to another; (3) the advantages gained by the change; (4) the disadvantages involved by the change, and the economic balancing of one against the others.

Factors Indicating the Need for Change

Unfortunately, most limestone quarries are covered with overburden, varying from thin loam to thick masses of unconsolidated material such as sand, clay or gravel, or compact strata of shale, sandstone or other rocks. Further surface topography seldom parallels subsurface geologic structure. Therefore, it is common to find a quarry originally opened in a fairly level limestone bed with a thin loam covering, to have reached in time a position where further advance entails heavy stripping from an elevation in surface topography. If the limestone bed is slightly inclined this condition is aggravated and if steeply inclined, lateral expansion of the quarry is limited to a narrow opening along the strike of the bed. Overburden removal costs money and the decision whether to strip and open quarry or to mine below the surface depends, in most cases, upon the difference between underground mining cost and surface mining plus stripping cost.

In some quarries limestone must be recovered clean and without discoloration or contamination with overlying clay. If the clay is dense and the surface of the limestone bed badly eroded, clean stripping is almost impossible and at best is expensive.

Quarries producing stone for lime can usually sort out clean stone of suitable size for stack kiln use but must waste the spalls or fines because of contamination with overburden. If these fines were clean they could in many cases be burned in rotary kilns.

Quarries in congested areas frequently are confronted with a serious problem in finding adequate space in which to dump overburden removed from the desired stone.

Overburden itself then is a considerable factor in directing the operator's thoughts toward a change from surface to underground mining because of the cost of removal, fear of contamination or lack of waste area.

Surface or open-pit operations at all times are subject to weather conditions. Cold winters render surface operations seasonal. Extreme heat reduces labor efficiency. Often valuable operating time is lost through local summer storms. The weather is thus a factor to be considered.

In many quarries, particularly those producing stone for the manufacture of lime, a difference in the chemical composition of separate limestone beds produces a major mining problem. If the overlying bed is unsuited for high grade lime, it must be removed and sold for other purposes or wasted.

As communities grow up around quarries, the operators encounter a serious difficulty in complaints of damage caused by heavy quarry blasting. Irrespective of whether the complaints are justifiable or not they are a source of growing annoyance. In some instances they have caused reduction of blasting charges to uneconomical amounts and in extremes, the total abandonment of the quarry. Encroachment of growing municipalities is therefore also a potential factor in causing consideration of a change in mining method.

The principal factors involved in the transition from open pit to underground mining are then overburden, clean stone, weather, the need for selective mining and municipal restrictions. Other factors may be contributary in certain localities.

Operating Changes Involved in the Transition

Underground mining is a more highly specialized operation than surface mining. A man may be an excellent open quarry operator but incompetent to conduct underground mining operations. The quarry management must consider first whether its directing personnel have the necessary knowledge and experience to convert their quarries, and subsequently, operate them efficiently and safely. I have encountered several instances where the conversion has been a complete failure due entirely to the inexperience of the quarry foreman in underground mining. No open quarry should be changed to underground without the benefit of competent technical advice.

In open quarry operation the superintendent can lay out his plan of operation so as to carry a long single face from which he takes one or more slices progressively. In underground operation, he must procure his stone from a number of small faces, none of which are directly connected. He must, in addition, so design his plan of attack as to have adequate pillar support to provide safe working places and safe covering over his haulageways. The problem of pillar size and spacing as well as mine plan is one which varies from mine to mine, because of purely local conditions. It is a technical problem requiring years of experience to solve. This is a problem for the solution of a competent mining engineer, experienced in mining limestone.

Underground mining requires a complete change in drilling and blasting practice, especially if churn drills or coyote blasting has been the practice in the open pit. If hammer drills and low benches have been the practice, underground operations will require less but nevertheless a significant change for efficient operation. Whereas with open pit operations most holes have two or more free faces to which they may break, in underground mining most holes will have one or two.

This requires more expert placing of holes and more care in loading to get adequate results. Underground blasting may also require a complete change in the type of explosive used. Blasting in confined places requires stronger explosives and they must be studied carefully for the type of fumes they evolve. Whereas black powder and straight dynamite may be used in open quarries, it is usually necessary to employ gelatin dynamites in underground work.

Underground drilling and blasting requires more drill operators than the open pit using churn drills, and thus more skilled labor. While it is true that underground limestone mining resembles coal mining methods in many respects, it does not follow that the experienced coal miner will make an efficient limestone miner. My experience has been that metal miners make better men for drilling and blasting in stone mines.

Broken stone in an underground mine must be loaded from comparatively small and sometimes confined spaces. Narrow beds restrict head room and prevent mechanical loading except with specially designed equipment. If the bed is thick enough to provide adequate head room the width of the room or working place may be so restricted for reasons of safety as to hamper lateral movement of loading equipment.

The transportation of broken stone from face to surface presents a different set of problems from those in surface mines. Steam locomotives (except the fireless type) are out of the question because of the danger from combustion gases and smoke. Gasoline locomotives are dangerous because of exhaust gases though they are used to some extent. Diesel locomotives are permissible for underground haulage in some foreign countries, since the amount of carbon monoxide contained in the exhaust is very small. In this country Diesel motors have not been unreservedly recommended but their use has been suggested under certain conditions. Automobile trucks are subject to the same objections as gasoline locomotives. Electric trolley or storage battery locomotives as well as those driven by compressed air are permissible. There is always danger from electrocution where a trolley is used however. The rubber conveyor belt is a potential means of transportation that deserves more attention.

In addition to these changes in the quarry haulage method transition from open pit to underground methods frequently necessitate the hoisting of stone through shafts. This not only involves the extra cost of hoisting but also requires an expensive outlay for mine development. The shaft must be sunk, levels driven at proper intervals and a ventilation shaft either sunk from surface or raised from below. High development expense is justified only where a large underground deposit exists and there is a demand for a large tonnage over sufficient period of time to write off the capital expenditure involved in mine development.

All operations in an underground mine must be carried on by artificial light. Operators who have endeavored to work open quarries by night will appreciate the additional equipment and expense involved in this necessity.

Ventilation must be provided, also. Open pit ventilation takes care of itself. Underground limestone mines are frequently adequately ventilated by natural means but only when proper mine design has been used. In extensive underground operations, artificial ventilation must be resorted to eventually, using fans and airways similar to coal mine practice.

The underground operator has a sometimes serious problem in mine drainage. Many open quarries drain themselves or if of the pit type they may be drained to a central sump and the water pumped from there. Many mines can be so arranged, but in most cases mining involves not only drainage to a central sump but elevation of the water from there to surface through heavy duty pumps.

The quarry management contemplating a change from open pit to underground operation should then consider carefully, (1) change to be made in directing heads and foremen; (2) changes to be made from unskilled to skilled labor; (3) changes necessary in drilling equipment including possible installation of a compressed air plant and new drill sharpening equipment; (4) changes in drilling and blasting practice; (5 purchase of new loading equipment; (6) alterations in haulage power and probably in care equipment; (7) provision for hoisting, if necessary; (8) provision for adequate lighting and ventilation; and (9) provision for constant and adequate safety inspection. Thus it is evident that each step in the operating cycle needs careful scrutiny and will involve changed practice.

Disadvantages Inherent in Underground Mining

The average operating cost of a number of underground limestone mines will be higher than an average of a similar group of surface quarries. Again, however, one is faced with the effect of local factors and the efficiency of management. I have observed underground limestone mines that have an over all operating cost, including deferred development expense, less than that of any open quarry with which I am familiar. As an example in point, I know of one mine which is producing limestone for less than 16 cents per ton, including all overhead expense. However, this is an exception and, broadly speaking, underground limestone mining may be estimated as costing 10 to 30% more than open pit mining.

In underground operations pillars must be left for roof support and haulage-way protection. In some cases also part of the good stone must be left in the roof in the absence of good roof material. In a few cases this is also true of the mine floor. This means that in underground mining rarely can 100% extraction of good stone be obtained and frequently not more than 50% is practicable. The open quarry, of course, can usually recover 100%.

Underground operations are dangerous and probably more dangerous to the uninitiated than open pit operations. The potential danger in underground workings, however, is largely dissipated if experienced workmen are employed. In my own experience, I venture to say I have seen as many dangerous practices carried on in open quarries as in underground mines. Experienced miners expect dangerous conditions and prepare for them.

Mines, except where artificially lighted, are dark. The miner must depend upon his cap lamp or some other type of artificial light. In working rooms permanent lights are prohibited because of blasting operations. Electric lighting on portable stands connected by properly armored cables has been used and flood lighting from a safe distance also but even under most favorable conditions the mine is not as well lighted as the open quarry in daytime.

Due to the larger cross-sectional area of working rooms and haulageways, limestone mines are easier to ventilate than metal or coal mines. As they are extended laterally, however, all will eventually reach a point where artificial ventilation is advisable.

Because blasting is limited to confined spaces, more spalls or fines are produced than in open quarry shooting.

Lastly, the underground mine requires more technical direction and more skilled labor.

Advantages of Mining

The underground mine has no overburden troubles comparable to those of the open pit. In rare instances under-

ground water courses have left open channels in the limestone strata which have subsequently become filled with clay. These, however, when found can usually be left in a pillar and avoided. There is, therefore, no expense attached to stripping, no discoloration or contamination and no problem of finding adequate space for overburden disposal.

The fines produced by underground mining are clean, and chemically, equally available for lime burning as the coarse material. This is an important advantage in some localities.

Protected from the weather and seasonal changes in temperature the underground miner can work day after day without interruption. Underground workings retain a more equable temperature regardless of surface conditions, thus avoiding excessively hot as well as cold and wet weather. Opportunity for constant and steady employment tends to create a contented personnel which is no small item in its effect upon efficiency.

Mining frequently permits removing a stratum of chemically satisfactory limestone without disturbing a low grade bed above. In this way underground mining may be selective to a considerable degree, whereas open pit operations must usually remove the entire face regardless of whether or not it contains poor stone.

Mined stone is clean stone, since there is no chance for contamination with overburden.

In some localities where open quarry blasting has caused complaints from neighboring residents, resulting in prohibitive municipal ordinances, recourse has been had to underground mining. By reducing the blasting operation from one large shot to many small ones the resulting vibration is less noticeable and causes less complaint.

Aged Lime Putty

Hayden Brooks, Standard Building Material Co., Birmingham, Ala., inventor of the Hayden Brooks method, described "The Preparation and Advantages of Aged Lime Putty." This is the method used by the Warner Co., whose plant at Wilmington, Del., was described and illustrated in the January and February, 1936, issues of Rock Products. Mr. Brooks' paper dealt largely with his own experience and success in marketing lime putty and ready-mixed mortar, and he urged the lime industry as a whole to promote the building of ready-mixed mortar plants in all the large cities, and the development of a quick-soaking lime hydrate to be used in improving the workability of mortar cements.

Refractories

Dr. R. P. Heuer, director of research, General Refractories Co., Philadelphia, Penn., had prepared a very comprehensive paper on "Refractories Used in Lime Burning," which was read in his absence by **L. J. Trostel,** chief chemist of the company. The paper was too technical to be abstracted here and a reprint of it will soon be made available to the lime industry by the General Refractories Co. It covers some of the same ground as the article published in Rock Products, December, 1934, except that it brings experience with some of the newer refractories up to date.

Agriculture

Dr. Jackson B. Hester, soil technologist, Virginia Truck Experiment Station, Norfolk, Va., gave some very valuable information on "Recent Developments in Soil Liming," with particular reference to Eastern seaboard soils. He made it clear that the use of lime in agriculture is not simply the application of lime to sour soil, but the use of the correct amount of lime for the particular soil condition and the crop. This involves accurate soil sampling and accurate determination of pH values of soils, and soil treatment with lime to give the right pH value for the requirement of crop. Even crops that thrive on acid soils need treatment if the pH value shows them too acid for optimum results.

Masonry Research

Walter C. Voss, professor of building construction, Massachusetts Institute of Technology, submitted a progress report on his masonry research program being carried out for the National Lime Association. This is receiving much publicity in the architectural and building magazines and has been of tremendous value in restoring the market to lime for mortars.

Plaster

John C. Best, president, Best Bros. Keene's Cement Co., Chicago, Ill., gave a heart-to-heart talk on the advantages of coöperation in industry. While he appeared in his private business capacity, he is also president of the Gypsum Association, which made his appearance before a lime manufacturers' meeting all the more significant.

Mr. Best's subject was "A Proposed Research to Develop Fire Resistive Lime Plaster," and while he did not dwell on the subject at length, it was apparent that he believes a satisfactorily fire-resistant lime plaster can be made by proper gauging of lime mortar with Keene's cement.

Co-operation

Nathan C. Rockwood, editor of Rock Products, was the last speaker on the program, prior to the election of officers and the adoption of the new budget. Under the title "What Coöperation in Industry Means," he discussed various phases of coöperative business activity with special reference to the lime industry. Those parts of this paper which are believed to be of general interest to all the rock products industry are given as an editorial in this issue of Rock Products.

Resumes Production

Medusa Portland Cement Co., Cleveland, Ohio, resumed production at its Bay Bridge, Ohio, plant, June 1, after a shutdown since October 15, 1935.

New Bulletin

Gypsum Association, Chicago, Ill., has issued a new illustrated booklet on gypsum lath in very attractive and informative style.

Projected Plant

Buckeye Sand and Supply Co., Bellaire, Ohio, is reported locally to be seeking a site in Wheeling, W. Va., for a distributing and ready-mixed concrete plant.

Fires Another Kiln

Universal Atlas Cement Co., Independence, Kan., plant put another kiln (the second) into production June 8.

Fire Loss

Yolo Gravel Co., Capay, Calif., plant was destroyed by fire May 28, with a loss estimated at $10,000. Defective electric wiring is given as the cause.

State Crushed Stone Plant

North Carolina Highway and Public Works Commission, Raleigh, N. C., has purchased 200 acres near Woodlawn in McDowell county for a quarry and crushing plant. Agricultural limestone will be produced also.

Capacity Doubled

Willapa Harbor Quarries, South Bend, Wash., have recently doubled capacity for crushed stone by installation of a roll crusher as a primary.

Fatal Blasting Accident

Clinton County, N. Y., had a fatal blasting accident at its quarry, Plattsburgh, N. Y., May 29. Two deaths, including that of the quarry superintendent, and one serious injury resulted from a delayed explosion.

Resumes Production

Colorado Fuel and Iron Co., Pueblo, Colo., has resumed operation of its dolomite quarry at Cañon City, producing 350 tons daily.

New Plant

D. L. Reynolds and L. L. Mullison, Monterey, Calif., are building a sand and gravel plant on the lower River ranch in Carmel valley.

New Plant

Matt Lappe, Carroll, Ia., is reported to have a new sand and gravel plant on the Coon river.

Plant Discontinued

Southwest Sand and Gravel Co., Springfield, Mo., has dismantled its plant at Pyatt, Ark.

Lime Producers' Forum

Conducted by Victor J. Azbe,
Consulting Engineer, St. Louis, Mo.

Calcining Efficiency of Dolomite Versus High Calcium Stone

RECENTLY an inquiry was received as follows:

"Under exactly equal conditions, same coal, same kilns, same firing methods, how much more fuel would be required to burn a ton of high calcium lime than would be required to burn a ton of dolomite?"

If we would care to just give a plain answer, without qualifications, we would say from 20 to 30% more; but the inquiry is important enough to justify a more elaborate reply. As there are many dolomite plants being operated most inefficiently without the management realizing, just because they compare their performance with high calcium plants, without numerically taking into consideration the great difference in the temperature, time and heat necessary to convert the two chemically different stones to lime.

The subject has been covered in a more basic manner in the August, 1935, issue of Rock Products Lime Forum, but a further more practical discussion should be well worth the limited space we have available.

The writer will never forget the time when a superintendent of a dolomite lime plant, having a fuel-lime ratio of 4 to 1, was sent to a high calcium lime plant where the ratio was 3.6 to 1, to instruct the superintendent of this plant in how to obtain a higher efficiency. The management was certainly tangled up in its ideas, and what it should have done was to send the high calcium lime plant superintendent to the dolomite plant to demonstrate how instead of their ratio being 4 to 1, it should have been closer to 4.5 to 1.

The accompanying curves demonstrate that the magnesium portion of so-called dolomite is dissociated at a much lower temperature than the calcium portion; that this takes place much higher up in the vertical kiln and much earlier in a rotary kiln, and so that a good part of the work has been accomplished ahead of the calcium stone's burning zone.

There are other plain indications. For example, waste-gas temperature on the Rockland-Rockport Mount kilns, calcining high calcium, averaged 700 deg. F., while the Warner Mount kiln, calcining magnesium stone, had an average waste gas temperature of 400 deg. F., or 300 deg. less—almost the exact difference in theoretical dissociation temperatures of high calcium and high magnesium stones.

Direct-fired Marblehead Lime Co.'s kiln was purposely left uncharged until waste gas temperatures reached the highest point, which was 1300 deg. F. Then the same was

Inquiries Invited

THE PURPOSE of this "Lime Forum" is what its name implies. The column conductor and the editor welcome inquiries in regard to specific problems in lime manufacture. If we can't answer them we shall seek the help of someone who can.

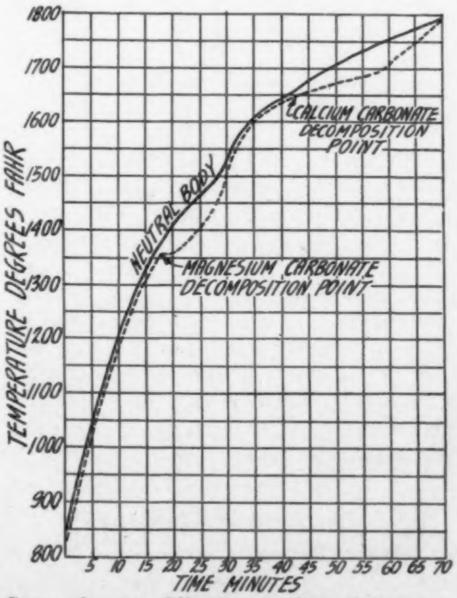
Such inquiries, as in the case of the one published on this page, may be confidential as to their source, if the inquirer desires it. All answers are by Victor J. Azbe, unless otherwise noted. There have been several requests for this kind of a "Forum", and we trust you will all make use of it.

—THE EDITOR.

tried on a direct-fired Warner kiln, temperatures reaching only 750 deg. F.

In a dolomite kiln the calcining zone is long, and even if the stone is initially very dense, when it reaches the high calcium dissociation zone it is porous, giving up its CO_2 with greater facility than some high calcium limestones.

Taking it all in all, since there are high calcium lime plants having ratios in excess of 5 to 1, there is no good reason why there should not be dolomitic lime plants having fuel ratios well in excess of 6.5 to 1. The southern shore of Lake Erie is plastered with acres of minute dolomite lime kilns, none of which does justice to the very fine stone burned. That the lime is good is in spite of the kilns, not in any way on account of them. That one cannot soft burn lime



Curve showing difference in dissociation temperatures of magnesium and calcium stones

in kilns having high capacity and high fuel ratio, has been thoroughly exploded.

There has been a case when high calcium stone was shipped to a wood-burning dolomite plant to be calcined. Initial results were very poor. Through special wood and special effort and after some time fair results were attained at an expenditure of 15% more wood. But as the wood was of a higher grade, one is safe in saying that the difference was at least the above stated 25%, plus more effort and likely more core.

The writer can readily imagine kiln conditions that still would calcine dolomite, but would not do so satisfactorily at all with a high calcium stone.

Changes Owners

Oregon Lime Products Co., Williams, Ore., has changed ownership. The majority interest had been owned by the Bristol family of Detroit, Mich., and Provolt, Ore. Buyers of their stock are James W. Pinniger (formerly of Kelley Island Lime and Transport Co.) and Glen Hunter, Provolt, Henry Wight, Millbury, Ohio; Walter Skilliter and Henry Bergman, Genoa, Ohio. Mr. Wight is an uncle of Mr. Pinniger. Directors elected include Henry Bergman, James Pinniger and Glen Hunter, replacing R. C. Bristol, Fay Bristol and Esther Bristol. Officers elected are Henry Bergman, president; James Pinniger, vice-president and treasurer; Glen Hunter, secretary. These replace R. C. Bristol, who was president and treasurer; Fay Bristol, vice-president and assistant treasurer; Esther Bristol, secretary. Fay Bristol and James Pinniger, have been at Williams for almost three years, developing the quarry located between Provolt and Williams. Its unusually pure limestone has made it an outstanding deposit on the coast.

By-Product CO_2 Project

California Lime Products Co., Ltd., Roseville, Placer county, Calif., according to Chas. Lumbard, president, is reviving plans to produce solid CO_2, or dry ice, as a by-product of lime manufacture.

Adds New Equipment

Longview-Saginaw Lime Works, Inc., Birmingham, Ala., has recently added a Raymond air separator unit for the manufacture of 400-mesh chemical hydrate. It is also used to make pulverized quick lime. A new 30-ton steel bin and three Bates valve-bag packing machines have been added for handling and shipping chemical hydrate.

Adds Dust Collectors

Leroy Lime and Crushed Stone Co., Leroy, N. Y., is installing a complete Norblo dust-collecting system in its crushing plant.

TRAFFIC and TRANSPORTATION

Proposed Rate Changes

THE FOLLOWING are the latest proposed changes in freight rates up to and including the week of June 20:

Trunk

Sup. 1 to 34629. **Slate,** crushed, dust or ground, C. L., minimum weight 50,000 lb., to North Brookfield, Mass., from Advance and Gladhill, Penn., $4.20 per net ton.

Sup. 2 to 34738. A—**Sand** (other than ground or pulverized or naturally bonded molding), and **gravel,** in open top car without tarpaulin, C. L., B—**sand and gravel** other than ground or pulverized, in closed cars, or in open top cars with protective covering, C. L., **sand,** naturally bonded molding, in open top or closed cars, C. L., C—**sand,** ground or pulverized, C. L., (See Note 2), to Methuen, Mass., from Perth Amboy-South Amboy Group, A and B $2.95 and C $3.20 per net ton.

Sup. 1 to 34741. **Stone,** crushed, C. L., (See Note 2), from Jamesville, N. Y., to points in Pennsylvania on the N. Y. O. & W. R. R., D. & H. R. R., Erie R. R. and W. B. & E. R. R., rates ranging from $1.20 to $1.70 per net ton.

Sup. 1 to 34758. **Slate,** crushed, dust or ground, C. L., minimum weight 50,000 lb., from Advance and Gladhill, Penn., to Watertown, Conn., $3.80 per net ton.

Sup. 1 to 34759. **Limestone,** crude, fluxing, foundry and furnace, in open top equipment, C. L., (See Note 2), to Mansfield, O., and Barberton, O., from Engle, Martinsburg, W. Va., Capon Road, Stephens City, Strasburg Junction, Va., Annville, Myerstown, Palmyra, Swatara, Penn., Inwood, W. Va., Williamson, Billmyer, Bellefonte, Pleasant Gap, Penn., Security, Marl, Md., Thomasville, Bittinger and York, Penn., $2 per gross ton.

Sup. 1 to 34765. **Stone,** crushed and screenings, in straight or mixed carloads (not agricultural or ground limestone, unburnt; fluxing stone or firestone; or stone, coated with oil, C. L., (See Note 2), from Winfield, Penn., to Forest City, Mayfield and Lake Ariel, Penn., $1.40; Pittston, Penn., $1.30; Plymouth, Penn., $1.20 per net ton; from Jamesville, N. Y., to Pittston, Penn., $1.30; Forest City, Penn., $1.40, and Mayfield, Penn., $1.50 per net ton.

34813. **(A) Stone, natural** (other than bituminous asphalt rock), crushed, C. L. **(B) Stone, natural** (other than bituminous asphalt rock), crushed, coated, C. L.,* (See Note 2), from Rochester, N. Y. (Rates in cents per 100 lb.)

To (N. Y.)	Proposed A	B
Maxwells	70	83
Caledonia	70	83
LeRoy	70	83
Golah	60	73

34826. **Slag** (refuse from antimony ore), C. L., (See Note 2), from Greensand, N. J., to Perth Amboy and Maurer, N. J., 7c per 100 lb., rate 9c per 100 lb.

34830. (A) To establish on **firestone,** sawed or chipped, from New Castle, Penn., to points in Official Classification territory, rates ranging from 90c to $4.80 per net ton; and (B) to cancel rates on **firestone,** rough dressed quarried, to the same points.

34832. **Stone,** crushed, coated, in bulk in open top equipment in straight carloads,* C. L., (See Note 2), from Monocacy, Penn., various rates to various points in Trunk Line territory.

34843. **Gravel, sand, slag and stone,** crushed, coated, in bulk in open top equipment, in straight carloads,* (See Note 2), from Greer, W. Va., to Webster Springs, W. Va., $1.77 per net ton.

34844. **Rubble stone,** C. L., minimum weight 50,000 lb., between points in Official Classification territory, including Extended Zone "C" in Wisconsin and W. T. L. Northwest territory, and from W. T. L. other than Northwest to Official territory rating in exception sheet of Class 20, commodity rates at variance therewith to be canceled.

*Note—The oil, tar and/or asphaltum not to exceed 10% by weight of the commodity shipped, the shipper to so specify on shipping orders and bills of lading.

34847. **Zircon sand and/or zirconium ore,** C. L., minimum weight 56,000 lb., to Louisville, Ky., from Norfolk and Newport News, Va., 30c; from New York, N. Y., 33c per 100 lb.

34852. **Sand** (other than ground or pulverized or naturally bonded molding), and **gravel,** in open top cars without tarpaulin, C. L., (See Note 2), to Nazareth and Wind Gap, Penn., from Netcong, N. J., 90c per net ton; from Carpenterville, N. J., to Wind Gap, Penn., 90c per net ton.

34863. **Crude gypsum rock,** C. L., (See Note 2), from Chester-Marcus Hook, Penn., to York, Penn., $1.80, Union Bridge, Md., $2 and Norfolk, Va., $2.50 per net ton.

34875. **Quarry waste,** consisting of crushed or broken stone, grout and rip-rap stone, C. L., minimum weight 80,000 lb., from Ambluco, N. Y., to various points in New York state, rates ranging from 75c to $1.60 per net ton.

34877. (A) **Sand** (other than ground or pulverized or naturally bonded moulding), in open top cars without tarpaulin or other protective covering; (B) **sand** (other than ground or pulverized) in closed cars; (C) **sand,** naturally bonded moulding, in open or closed cars, (See Note 2), from Daguscahonda, Penn. Proposed rates in cents per 2000 lb.

To	A	B&C
Montreal, Que.	455	495
Toronto, Ont.	305	345
Hamilton, Ont.	265	305

34894. **Stone, crushed,** coated with tar, oil or asphaltum, in bulk in open top equipment, in straight carloads,* (See Note 2), from Kingston, N. J., to Long Island Railroad stations Group A $1.73, Group B $1.93, Group C $2.23, and Group D $2.53 per net ton. Reason: Related to rates to Jersey City.

34897. **Stone, crushed,** coated with oil, tar or asphaltum, C. L., (See Note 2), from Myerstown and Winfield, Penn., to various points in Pennsylvania, rates ranging from $1.18 to $2.85 per net ton.

34906. **Limestone, ground or pulverized,** C. L., minimum weight 60,000 lb., from Norfolk, N. Y., to various points in New York state on the N. Y. C. R. R., rates ranging from $1.10 to $1.70 per net ton.

Central

46872. To establish on **crushed stone** in open top cars, carload, (See Note 3), from Melvin, Ohio, to Blanchester, Ohio, rate of $15 per car to apply only movement of three or more cars at same time.

46995. To establish on **limestone,** ground, C. L., but not less than 60,000 lb., from Beachville, Ont., to Detroit, Mich., 11½c, and Akron, O., 13c.

46998. To establish on (A) **Sand,** naturally bonded moulding, in all kinds of equipment, C. L.; sand (except naturally bonded moulding; ground or pulverized sand), in closed equipment, C. L. (B) Sand, ground or pulverized, in all kinds of equipment, C. L. (C) Sand (except naturally bonded moulding; ground or pulverized sand), in open top equipment, C. L., (See Note 3), but not for closed and open top cars of less marked capacity than 60,000 and 80,000 lb., respectively, to Rochester, N. Y., from Muskegon, Grand Haven and Rosymound, Mich. (A) 290c, (B) 319c, and (C) 290c per net ton.

47013. To establish on **crushed stone** and **crushed stone screenings,** in straight or mixed carloads, in open top cars, from Marblehead, O., to Erie, Penn., 150c, and Waterford, Penn., 160c per net ton.

47014. To establish on **precipitated calcium carbonate, N. O. I. B. N.,** in official classification, C. L., minimum weight 40,000 lb., from Painesville, O., Kansas City, Mo., 37c.

47018. To establish on **sand,** except industrial, and **gravel,** in open top cars, C. L., from R. A. Junction, O., to N. & W. Ry. stations, viz., North Kenova, South Point, 95c; Sheridan and Coal Grove, O., 100c per net ton.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

47023. To establish on **limestone,** ground or pulverized, unburnt; **limestone dust,** unburnt, or **limestone, agricultural,** unburnt; in box cars, C. L., from Mosher and Ste. Genevieve, Mo., to Indianapolis, Ind., Louisville, Ky., 13½c; Detroit, Mich., 17c; Cincinnati, O., 15c; Cleveland, O., 18c, and Evansville, Ind., 12c. (Lime rates in effect from Mosher and Ste. Genevieve, Mo., based on 50,000 lb.)

47064. To establish on **carbonate of lime,** C. L., minimum weight 40,000 lb., from Mosher, Ind. To: Boston, Mass., 39c; New Haven, Conn., 39c; New York, N. Y., 32½c; Brooklyn, N. Y., 32½c; Long Island City, N. Y., 32½c; Atlantic City, N. Y., 32½c; Bloomfield, N. J., 32½c; Jersey City,, N. J., 32½c; Newark, N. J., 32½c; New Brunswick, N. J., 32½c; Philadelphia,, Penn., 31c; Buffalo, N. Y., 26½c; Cleveland, O., 23c; Akron, O., 23c; Otsego, Mich., 21c; Kalamazoo, Mich., 21c; Detroit, Mich., 22c; Wabash, Ind., 18½c per 100 lb.

47080. To establish on **crushed stone,** in bulk, stone screenings, stone tailings, in bulk, rip-rap,, quarry scrap and agricultural limestone, in bulk, C. L., in open top cars, from Greencastle and Limedale, Ind., to points in Illinois. (Rates in cents per net ton.)

To	Prop.	To	Prop.
Toledo	113	Decatur	113
Janesville	113	Beardsdale	126
Lerna	113	Warrensburg	126
Jones	113	Lathan	126
Mattoon	113	Mt. Pulaski	126
Allenville	113	Lincoln	126
Sullivan	133	Hartsburg	136
Bethany	113	Emden	136
Dalton City	113	Delavan	136
Harvey City	113	Green Valley	136
Mt. Zion	113	Pekin	136
Suffern	113		

47084. To establish on **dolomite,** roasted, C. L., from Woodville, Gibsonburg, Bettsville and Maple Grove, O., to Sterling and Sterling (Rock Falls) Ill., $3.70.

47085. To establish on **sand and gravel,** C. L., from Phalanx, O., to Ohio points. (Proposed rates in cents per net ton):

To	A	B	To	A	B
Plymouth	120	138	Summit (Richland Co.)	120	138
New London	120	138	Mansfield	120	138
Milton	120	138	Shelby	120	138
Pavonia	120	138			

A—In open top equipment. B—In box car equipment.

47140. To establish on **dolomite,** roasted (refractory), C. L., (See Note 3), from Carey, O., to points in Indiana, Pennsylvania, Ohio, Illinois, Kentucky, New York, West Virginia, Iowa, Michigan and Missouri, rates ranging from 105 to 300c per net ton.

47148. To establish on **slag** (refuse from vanadium ore, containing no mineral value), C. L., min. wt. 60,000 lb., from Columbiana, O., to New Castle, Penn., 120c per net ton, subject to emergency charges.

47180. To establish on **crushed stone,** in bulk, in open top cars, C. L., (See Note 3), from Spencer, Ind., to Burns City, Union, Odon, Elnora, Averitt and Ilene, Ind., 60c per net ton.

47181. To establish on **crushed stone, chatt, slag** and/or **gravel,** coated,* in open top cars, C. L., minimum weight, from Joliet, Ill., to Ft. Wayne, Ind., 176c per net ton.

47202. To establish on **sand** (other than industrial) and **gravel,** in open top cars, C. L., from Massillon, O., to North Randall, Aurora, 90c; Mantua, 95c; Hiram Garrettsville and Mahoning, O., 90c per net ton, subject to emergency charges.

47215. To establish on **naturally bonded moulding sand,** C. L., (See Note 3), but orders will not be accepted for closed and open top cars of less marked capacity than 60,000 and 80,000 lb., respectively, from Benton Harbor, Mich., to Milwaukee, Wis., 185c per net ton.

47217. To establish on **limestone,** ground or pulverized, and **limestone dust,** unburnt, in box cars, C. L., from Ridgeville, Ind., to Beesons, 140c; Bristol, 145c; Brookville, 140c; Morehous and Vistula, Ind., 145c per net ton.

47226. To amend minimum weight in connection with **crushed stone,** in D. & T. S. L. R. R. Tariff G. F. D. No. 3-D, from stations on the D. & T. S. L. R. R. to points in Illinois, Indiana, Kentucky, Michigan, Missouri, New York, Ohio, Ontario, Pennsylvania, West Virginia and Wisconsin to be as in Note 3, but not less than 80,000 lb. in open top cars.

47231. To establish on **crushed stone,** in open top cars, C. L., from Lewisburg, O., to Union Village, Centerville, Glenwood and Hageman, O., 80c; Miltomson, Brecon, 85c; Deer Park and Kennedy Heights, O., 90c per net ton, subject to Emergency Tariff 542-A.

47232. To establish on **crude slag,** in open top cars, C. L., min. wt. 90,000 lb., from New Boston, O., to Franklin Furnace, 40c; Henley, Barden, Haverhill, 50c; Wheelersburg, 40c, and Otway, O., 50c per net ton, subject to emergency charge.

47242. To establish on **limestone,** unburned, agricultural (in bulk in open top cars), C. L., from Spore, O., to Ashtabula, 125c; and Conneaut, O., 135c per net ton.

47250. To establish on **crushed stone and crushed stone screenings, in bulk** in open top cars, C. L., from West Columbus, O., to Millwood, 160c; Ravenswood, 170c; Ripley, 180c, and Spencer, W. Va., 190c per net ton.

47251. To establish on **fire stone,** rough quarried, C. L., min. wt. 50,000 lb., from Blue Stone and Farmer, Ky., to South Haven, Mich., 335c per net ton.

47254. To establish on **crushed slag,** in open top cars, C. L., from Hamilton, O., to Jamestown, 90c, and Wright, O., 80c per net ton.

47259. To establish on **gravel,** traffic bound (passing through 1-in. screen), C. L. from Attica, Ind., to Shumway and Effingham, Ill., 78c per net ton, to expire same as rate from Riverton, Ind., Aug. 31, 1936.

47260. To establish on **quarry scrap stone, rip rap, rough stone and rubble stone,** C. L., from Marble Cliff, O., to Grand Rapids, (1) 300c; Mt. Pleasant, (2) 320c; Ludington, (2) 360c, and Traverse City, Mich., (1) 360c per net ton.

(1) Via P. R. R. direct.
(2) Via P. R. R., Toledo, O., P. M. Ry.

47262. To cancel rates on **agricultural limestone,** unburnt, from Bellevue, O., to Bentleyville, Penn., Butler, Penn., Clarkesburg, W. Va., Jamestown, N. Y., and Meadville, Penn. Classification basis to apply.

47275. To establish on **agricultural limestone,** unburnt, ground or pulverized, in box cars, in bulk or in packages, C. L., min. wt., 50,000 lb. from Rockford, O., to various destinations in Indiana and Ohio, rates on the same percentage relationship to the 1st class rates as in present rates from Genoa and Martin, O. (representative rates shown, subject to emergency tariff, in cents per net ton).

To Albion, Ind., 175c; Anderson, Ind., 165c; Elkhart, Ind., 180c, †185c; Kendallville, Ind., 160c; Marion, Ind., 140c; South Bend, Ind., 180c; Alliance, Ohio, 180c; Bryan, Ohio. 110c; Chillicothe, Ohio, 150c; Deshler, Ohio, 110c; Fostoria, Ohio, 120c; Hamilton, Ohio, 140c; Lancaster, Ohio, 140c; Portsmouth, Ohio, 180c; Steubenville, Ohio, 180c; Van Wert, Ohio, 70c; Washington C. H., Ohio, 140c.

† Proposed $1.80 per ton account intermediate to Mishawaka, Ind.

47308. To establish on **agricultural limestone and agricultural limestone screenings,** C. L., from Bloomville, Maple Grove, Gibsonburg and Woodville, Ohio, to Salineville, Roswell, Kensington, East Rochester, East Liverpool and Summitville, Ohio, various rates ranging from 125c to 155c per net ton.

Southern

11804. Establish rate of $3.69 per net ton on **phosphate rock and limestone, phosphatic, C. L.,** as in Item 42 of L. & N. R. R. G. F. O. 44-D, I. C. C. A-16079, from Mt. Pleasant-Centreville district to Lansing, Mich. To expire December 31, 1936.

11861. Establish rate of 90c per net ton on **feldspar,** C. L., minimum weight 60,000 lb. from Gilkey, N. C., to Erwin, Tenn., and Toecane, N. C.

11875. Establish from Martinsville, Va., to Biltmore, N. C., rate of 250c per net ton on **mica, crude, scrap or waste, suitable for grinding purposes only, C. L.,** minimum weight 60,000 lb.

11912. Establish $2.30 net ton **limestone or marble, crushed or ground, in paper lined burlap bags or barrels, straight or mixed, C. L.,** min. 60,000 lb., Cartersville, Ga., to South Atlantic ports for transhipment to Pacific coast. (Not including shipside charges.)

Western

E-41-162. **Stone** (crushed); **stone,** rubble of irregular random size, not trimmed, not suitable for manufacture, actual value at origin point not in excess of $4.50 per ton; **stone,** rip-rap; **chatts** (lead or zinc mine refuse) and strippings of stone quarries, C. L.; (See Note 3); not less than 40,000 lb., from Ablemans, Berlin, Lohrville, Montello, Red Granite, Stevens Point, Utley and Waupaca, Wis., to E. St. Louis, Ill., Litchfield, Ill., and St. Louis, Mo. Proposed, 12½c per 100 lb.

Sup. 1 to D-41-164. **Sand,** C. L., (See Note 3), from Gray Summit and Pacific, Mo., to Denver, Colo. Proposed—$3.95 per ton of 2000 lb.

D-41-165. **Limestone,** ground; **chat** and/or **stone,** crushed, in sacks, in mixed carloads, in closed cars, minimum weight applicable on limestone, ground or stone, crushed, from White Bear, Mo., to points in Western Trunk Line territory. Proposed—Ground limestone commodity rate. If no ground limestone rate, crushed stone commodity rate to apply.

D-41-166. **Gravel, gravel pit strippings;** also **gravel,** crushed, (See Note 2), but not less than 60,000 lb., except when cars are loaded to full visible capacity, in which case actual weight will govern, from Jedburg, Mo., Pacific, Mo., and Yeatman, Mo., to Lowell, Ind. Proposed—$2.33 per ton of 2000 lb.

D-41-167. **Limestone,** crushed or ground, (See Note 3). In no case less than 40,000 lb., from Omaha, Neb., to Milwaukee, Wis. Proposed, 13¾c per 100 lb.

C-41-168. **Sand,** naturally bonded moulding, from Rockton, Ill., to Steelton and Duluth, Minn. Proposed, 260c per net ton, (See Note 3), but orders will not be accepted for cars less than 80,000 lb.

C-41-169. **Gypsum rock,** C. L., minimum wt. as established from Blue Rapids, Kan. Proposed: To Chanute, 7c; Fredonia, 7c; Independence, 7c; Iola, 7c; Humboldt, 7c; Dewey, Okla., 7c.

Southwestern

8419. To amend Item 500-B of W. T. L. Tariff 91-G, applying on **agricultural limestone** (for land fertilization purposes only) to include Williams Quarry Spur, Mo., as a point of origin.

8438. To establish rates on **crushed stone,** including ground limestone from Limedale Spur, Ark., to various stations in Tennessee and Mississippi based on the 17000, part 11 scale plus 6c for river transfer.

8439. To establish rate of 12½c per 100 lb. on **gypsum rock,** carloads, minimum 100,000 lb., except in cars of less capacity, (See Note 1), but not less than 80,000 lb., from Acme, Tex., to Foreman and Okay Junction, Ark.

Texas-Louisiana

7969-9-TX. To establish rate of 60c per ton of 2000 lb. on **sand and gravel,** standard minimum weight, from Hobbs Spur to Burkland, Tex. To expire Dec. 31, 1936. This material, amounting to some 3250 tons, is to be used in the construction of an underpass near Round Rock, unloading set-up to be located at Burkland, and, unless the rate proposed is established, will be purchased from producers in Austin and handled by trucks to construction site.

8659-TX. To establish on **stone, sand and gravel;** stone, crushed (broken stone ranging in size up to 200 lb. weight), minimum weight as in Item 2395, Texas Lines' Tariff 2M, but not less than 72,000 lb., from Edgin to the following points in Texas, in cents per net ton.

To Giles, 55c; Hedley, 55c; Lelia Lake, 60c; Clarendon, 60c; Ashtola, 70c; Goodnight, 70; Malden, 70c; Claude, 70c; Kasota, 70c; Washburn, 70c.

This proposal is to establish from Edgin, Tex., the same rates as are applicable from Quitaque, Tex. The rates are necessary to meet the same character of competition that existed when rates were established from Quitaque, Tex.

9737-TX. To establish rates in cents per ton of 2000 lb. on **crushed stone,** carloads, (See Note 3), from Jacksboro to Dallas, 84c; to Ft. Worth, 69c, subject to routing on C. R. I. & G. Ry.

In view of recent reduction made in the rate from Lone Star Spur, shipper located at Jacksboro advises that he is unable to compete in the Dallas and Ft. Worth market with the producer at Lone Star Spur.

Illinois

3339-16. **Crushed stone chatt, gravel and/or sand,** coated with oil tar, asphalt or asphaltum, C. L., between points in I. R. C. territory. Establish rate so as to be not more than 20c per ton higher than rates current on the uncoated materials.

4392-6. **Limestone,** ground, **chat** and/or **stone,** crushed, in sacks, in mixed C. L., in closed cars, min. wt. applicable from White Bear, Mo., to I. R. C. points. Proposed, ground limestone commodity rate. If not ground limestone rate, crushed stone rate to apply.

7429-1. **Sand,** other than moulding, C. L., Arenzville, Ill., to Peoria, Ill. Proposed—$1 net ton.

8283. **Sand and gravel,** C. L., (See Note 3), but in no case less than 40,000 lb., from Oak Hill, Ill., to destinations in Illinois on C. B. & Q. R. R. (Rates in cents per net ton.) To (representative points): Zearing, 85; Altona, 80; Galesburg, 70; Kasbeer, 100; Burnett, 78; Monica, 60; Norris, 66; Nekoma, 90; Coatsburg, 110; Bluff Head, 116; Morris, 129; Litchfield, 120.

I. C. C. Reports

4202. Proposed reduced rates, **sand and gravel,** Cayuga, Ind., to destinations in central Illinois found justified to Brisco, Ill., but not to other destinations. The finding of non-justification is without prejudice to filing of new schedules establishing from Cayuga to Briscoe, on not less than one day's notice, a rate of 63c to expire August 15, without reducing rates to intermediate destinations. Fourth section departures are authorized in Order 12356. Rate to Briscoe was reduced to meet competition of wayside sand and gravel pits, in construction of a road near Briscoe.

A revision of rates, based on a finding of unreasonableness, has been ordered, effective not later than September 3, in **26937,** National Mortar & Supply Co. vs. Pennsylvania et al.; **27008,** Laurens Glass Works, Inc., vs. C. & W. C. et al.; and **27012,** Chattanooga Glass Co. vs. Pennsylvania et al. The Commission, by division 2, found rates, on **lime,** Gibsonburg, Woodville and Cold Springs, O., to all points in southern territory unreasonable for the future and from Gibsonburg to Laurens, S. C., and Chattanooga, Tenn., and for other points involved, not unreasonable in the past but unreasonable for the future.

4160. By division 3. Proposed restriction in present rule governing mixed carloads of common **lime,** agricultural lime, and agricultural, ground or pulverized **limestone,** between points in central and trunk line territories so as not to apply on mixed carloads of those materials to destinations in New York, or over routes through that state to destinations beyond, found not justified. Suspended schedules ordered canceled.

Louisiana Rates Revised

The Louisiana Public Service Commission, as of June 1, revised freight rates on sand and gravel from points in the state east of the Mississippi river to New Orleans. It ordered the Gulf, Mobile and Northern railroad and the Illinois Central system to publish rates of 80c a ton, usual minimum weight, from points between 50 and 80 miles from New Orleans. The Charles Black Sand and Gravel Co., Fluker, La., had complained that, under a commission order of June 1, 1932, rates were on a mileage progression scale discriminatory to some pits.

Firm Asks I.C.C. to Lower Rates

Williams Lime Manufacturing Co., Knoxville, Tenn., has requested the Interstate Commerce Commission to lower its shipping rates on lime to destinations in Ohio, Indiana, Illinois and West Virginia. Corresponding rates are lower for competitors at Mitchell and Milltown, Ind., and Marble Cliff, Ohio, the Williams company asserted. A previous decision on the case by Division 4 refused to lower the tariffs, and the company is appealing to the Commission itself.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Adds Cement Handling Equipment To Batching Plant

CLIFTON COAL AND SUPPLY CO., dealing in building supplies, has been producing transit-mixed concrete since June, 1935, at its Lakewood, Ohio, yard. When first erected, the plant consisted of batching bins and weighing and other necessary equipment for aggregates only and was without equipment for handling cement. Cement was loaded into the transit-mix trucks by bags, but recently equipment was installed for handling cement in bulk.

The plant is located adjacent to a railroad siding, and aggregate and cement are hauled in in bulk. Aggregates are dumped from the car through a bottom gate to a small steel hopper which, in turn, feeds to an 18-in. belt conveyor, 12 ft. c. to. c., driven by a 10-hp. motor. This conveyor discharges into the foot end of a bucket elevator, which carries the aggregate to the top of the Butler bin. The bin is partitioned off to give two 70-ton bins for fine and coarse aggregate, respectively.

Aggregate is drawn from these bins and weighed out in a manually operated Butler batcher before shipment in trucks.

A Johnson cement bin of 250 bbl. capacity was set up as a separate unit adjacent to the other bin. Cement is dumped from cars to a Webster screw conveyor which carries the bulk cement to the elevator going to the bin. The cement handling plant is equipped with a Richardson Duo-Screw au-

Transit-mixed concrete plant and equipment of Clifton Coal and Supply Co.

tomatic scale and batcher. The bin feeds by gravity to the bottom end of the two screws which push the cement upwards into the hopper. The larger screw is driven by a 5-hp. Master motor and worm gear speed reducer (Horsburgh & Scott), and the smaller screw is driven by a 2-hp. Master motor and reducer.

After the scales are set and the feed turned on, the two screws operate simultaneously until the batcher approaches the scale reading. The larger screw then shuts off and the smaller one operates until the exact reading is attained.

The push button will not release the load to the truck unless the batch is exactly what the scale reading calls for.

The plant is equipped with two 1½-yd Rex transit-mixers, manufactured by Chain Belt Co., mounted on Ford V-8 trucks. The trucks are driven under the aggregate batcher and get the load of aggregate and water—from a 500-gal. tank—and then move under the cement bin and out of the yard in one direction. The two units of the plant have been enclosed and heating equipment installed for winter use since the photograph herewith was taken.

Good Start

St. Lawrence Concrete Products Co., Ogdensburg, N. Y., has completed and placed in production a new plant with a $350 weekly payroll and using $700 worth of crushed stone per week from a local quarry (Arthur McConvill's). John C. Tulloch is president of the company, Eric McKinstry, Kemptville, is vice-president and Ralph P. Wells, secretary-treasurer and general manager. Mr. McKinstry is general manager of the Dominion Concrete Co., Canada, with which the Ogdensburg company is associated. The Dominion Concrete Co. manufactures concrete tile, fence posts, etc., in two Canadian plants. It has just secured a $75,000 contract for drainage from the city of Toronto and the Dominion government has given large orders for government projects. At the Ogdensburg plant tile in sizes from 6 to 24 in. is being made and about 4000 ft. have been cast. Production of reinforced concrete fence posts will start shortly.

Products Plant

Gravel Products Corp., Buffalo, N. Y., started capacity production, on June 15 at its new $75,000 plant in Tonawanda, N. Y., of concrete pipe. Both McCracken and Quinn pipe-making machines are used.

New Product

Illinois Concrete Crib Works, Mendota, Ill., is the name of a new industry making concrete blocks of special design for the construction of farm corn cribs. H. E. Rose is the manager.

Truck for transit-mixed concrete at Atlanta Aggregate Co., Inc.

New Business

Atlanta Aggregate Co., Inc., Atlanta, Ga., has entered the transit-mixed concrete field. According to W. M. Center, president, the installation of truck mixers has enabled this 10-year-old company to broaden its ready-mixed service to include the road builder as well as the building contractor and to furnish certified concrete, mixed to any specification, direct to the forms.

Within a short time after installation of its first fleet of Jaeger "Dual-Mix" truck mixers, 30,000 cu. yd. of certified concrete have been furnished to Atlanta contractors, including the Techwood Housing Project, 8000 cu. yd. on the U. S. Post Office in Atlanta, 2000 cu. yd. on Agnes Scott College at Decatur, Ga., and over 6000 cu. yd. on local street and viaduct work. The company states that it now has orders for immediate delivery of nearly 10,000 cu. yd. and has found it necessary to order a second fleet of truck mixers to keep pace with the demand.

Due to the fact that they can be mounted on small, short wheel base trucks which are easily maneuvered in traffic and around the job, the company has standardized on truck mixers of 1½-cu. yd. capacity, which have been found most flexible as well as economical for general service.

New Use for Cement

Bakelite Building Products Co., Inc., New York City, has developed a new type of hydraulic cement-coated, asphalt shingle. This shingle, which is known generically in the building industry as a "cementop" shingle, is now being produced by several leading roofing material manufacturers.

The process consists of applying a coating of hydraulic cement over the mineral granules. The cementop shingle is made in practically the same way as the conventional asphalt shingle, after which it is given a surface coating of special-formula hydraulic cement which is applied over the mineral granules. Stable mineral pigments are incorporated to give the shingle a wide range of colors,—white, black, greens, reds, greys, and blues. Bright permanent colors are possible with an absence of "blooming."

The cement coating provides the cementop shingle with a number of distinct advantages. It gives the shingle rigidity, greater insulation value, and better resistance to fire and erosion. It acts as a shield protecting the asphalt beneath from the destructive actinic and ultraviolet light rays of the sun. It seals the asphalt so effectively that oils or other volatile elements present in the shingle will not bake out so readily, thus increasing the life of the shingle.

After the cement coating has been applied to the surface of these shingles, they are stacked upon a form that is slightly convex. When the cement has set and hardened, the shingles remain convex on the weather side. The coating increases the weight by 20 lb. per 100 sq. ft., and it imparts a rigidity that resists flexing toward the weather side. Consequently, these shingles will not lift in the wind, yet they are sufficiently flexible in the opposite direction to conform with unevenness in the roof.

Still another advantage of the curvature is that when the cementop shingle is applied to the roof, the butt is under compression, and in close, firm contact with the structure beneath. When used as a siding, the cementop shingle will conform to the irregularities in the surface.

The cement coating serves as a support for nail heads in holding the shingle in place. This factor facilitates application to the roof or side walls. Nails may be driven easily without crushing the material about the nail heads, and only two nails are needed for each shingle. The possibility of leakage through nail holes is eliminated because no exposed nailing is required.

Those concerns which have already started production, or will be in production shortly, are: Johns-Manville Corp.; the Ruberoid Co.; McHenry-Millhouse Manufacturing Co. of New York, Inc.; American Asphalt Roof Corp.; the Logan-Long Co.; Los Angeles Paper Manufacturing Co. (El Rey Products); the Lehon Co.; and the Certain-teed Products Corp.

New Plant

Hartford City Burial Vault and Cement Products, Hartford City, Ind., is a new enterprise manufacturing reinforced-concrete burial vaults, concrete fence posts and concrete block. Edward J. Schantz is manager.

Buys Sand Plant

Concrete Conduit Co., Ltd., Colton, Calif., has purchased the **Concrete Rock and Sand Co.,** and will expand its manufacturing facilities.

More Capacity

Columbia Concrete Pipe Co., Wenatchee, Wash., has outgrown a 4-year old plant and moved to a new location and installed a plant of larger capacity. A. B. Metcalf is manager.

New Machinery and Equipment

Belt Vulcanizer

B. F. GOODRICH CO., Akron, Ohio, announces the No. 28 aluminum "one-man" vulcanizer for splices in rubber coated belting up to 28 in. wide. The weight has been reduced to under 300 lb., making it 75% lighter; it is claimed either of the two platens can be handled by one man, or the whole unit lifted by two men. It is said to be able to vulcanize narrow transmission belts up to 10 in., 6-ply inclusive, in one heat. Unit is available in 110 or 220 volts a.-c. and d.-c., 110 and 220 volts a.-c., 110 or 220 volts a.-c.—d.-c. The d.-c. types may also be used for a.-c. of equal voltage by changing the plug-in connections on the side of the vulcanizer. The vulcanizer comes equipped with curing pad and galvanized sheet covers. No clamping bars are necessary.

One-man belt vulcanizer

Portable Cable Accessories

GENERAL ELECTRIC CO., Schenectady, N. Y., has announced a line of portable cable accessories, which includes high-voltage cable couplers and molded terminals for all voltages, designed to incorporate safety, long wear, and convenience in the field. The high-voltage couplers can be used to provide a satisfactory method to connect apparatus and to connect lengths of portable cable together.

The couplers, which are rated at 100 amperes, are particularly adapted for use with G.-E. 2500-, 3500-, and 5000-volt, Types SH and G, portable cables. Provision is made in the coupler socket so that the shielding tapes or ground conductors of the cable can be brought out for grounding purposes.

Both the socket and plug are equipped with a cover to prevent the entrance of dirt and moisture when the coupler is disconnected. The coupler socket and plug are made of a malleable-iron frame with a malleable-iron end bell, bolted on. The current-carrying contacts are the sliding-spring type, enclosed and shielded by Herkolite tubing. There are four contacts, three of which are for the individual conductors of a three-conductor cable; the fourth contact is for the shielding braid or ground wires.

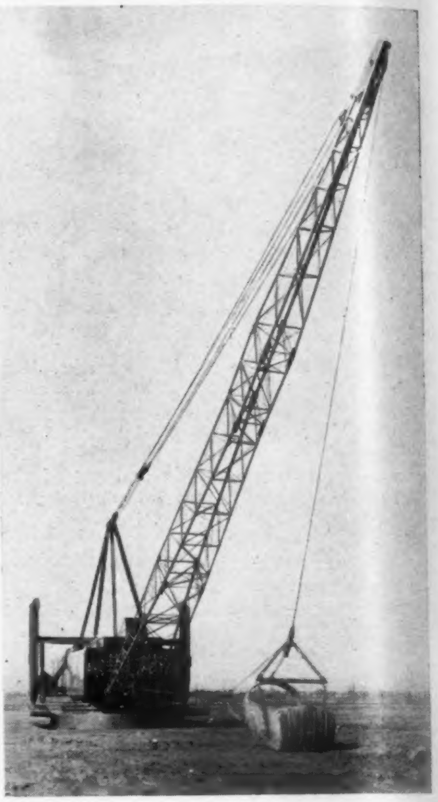
That the coupler may be used as a connector between cable lengths, the end bells have been made interchangeable so that the plug-end bell may be put on the socket end in place of the socket-end bell and flexible connections made at each end of the coupler.

The new molded-rubber terminal is for cases where it is desirable to terminate portable or drag cable at the source of energy or at the load by means of a terminal which will hold the single conductors firmly together as a unit. The terminal is made of G.-E., R-387, tellurium compound and provides means of properly terminating ground wires and braided shields so that they can be correctly grounded.

Walking Dragline

PAGE ENGINEERING CO., Chicago, Ill., has a new type walking dragline machine built in sizes ranging from 2½ to 20 cu. yd. and known as series "600." The new series "600" is of the two-shoe type. By means of a direct drive from engine to the cranks attached to side-mounted shoes, movements are made, lifting and sliding the machine for a step of 6 ft. Steps are automatic at the rate of three per minute. When the machine is digging, the shoes are held well above the ground by an automatically set brake.

Advantages claimed for the series "600" Page "Walker" are its complete movability

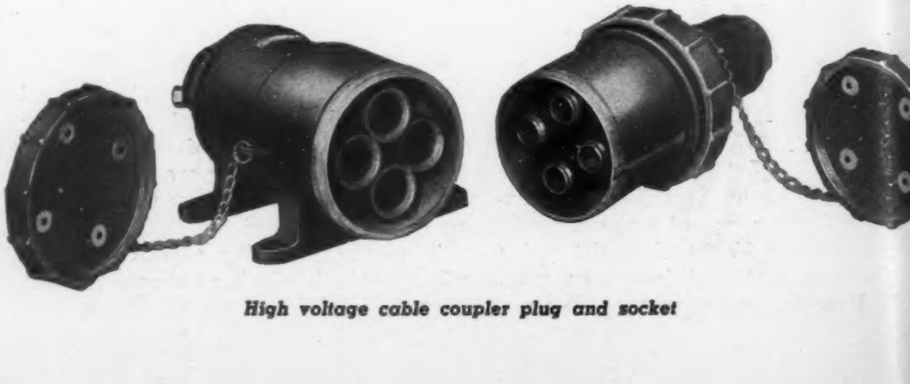


Dragline with high swinging hoist

in any direction—the economical, medium speed, horizontal Page Diesel engine—the large base or tub thus giving ample footing for working even on the softest ground—the high fairlead which saves wear on cable—the welded alloy steel boom—the unusually high swinging hoist and load speeds.

Welding Electrodes

HARNISCHFEGER CORP., Milwaukee, Wis., announces a new line of coated rods for d.-c. welding, including five different types with both high and low rates of fluidity for various types of work in flat, vertical or overhead positions and with ferrous and non-ferrous metals. Service tests are said to show tensile strength of welds from 55,000 to 75,000 lb. per sq. in. with various types of rods ranging from

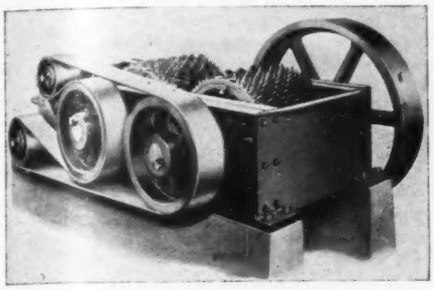


High voltage cable coupler plug and socket

3/32 in. to 3/8 in. in size. "Smoothare" electrodes are designed primarily to speed up welding operations with a smoother, more easily handled arc and to reduce spatter losses.

Roll Crusher

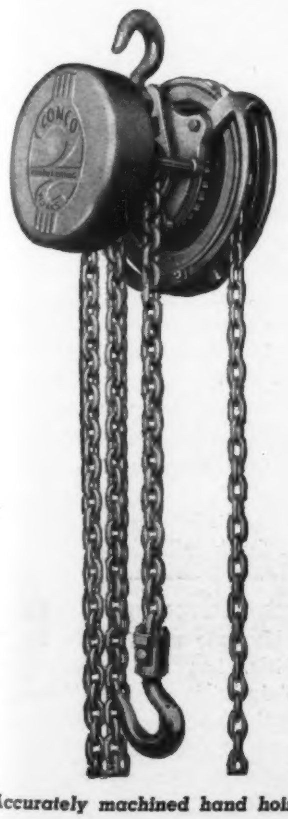
JEFFREY MANUFACTURING CO., Columbus, Ohio, has developed a new design of double-roll crusher. The chief feature of this machine is a self-contained endless belt drive between the rolls which allows quick adjustment of the rolls within the limits of the sizing range while the machine is running. The crusher is also provided with an all steel frame having heavy steel cross-ties.



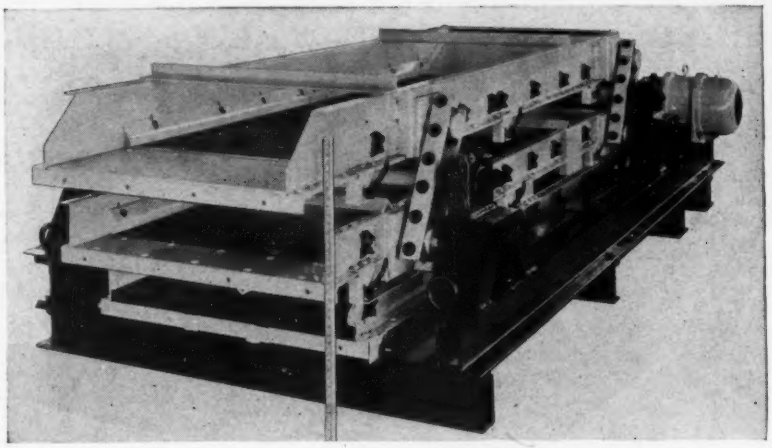
Double-roll crusher

Hand-Chain Hoists

CONCO ENGINEERING WORKS, Mendota, Ill., is introducing a spur-geared, hand-chain hoist, in which precision ball bearings and accurately machined parts are features. The type illustrated is made in capacities from 1/4 to 6 tons.



Accurately machined hand hoist



Vibrating screen that operates on a level plane

Vibrating Screen

HENDRICK MANUFACTURING CO., Carbondale, Penn., has recently placed on the market a new screen, operating on a level plane, that combines shaking and whipping in one operation. The manufacturer claims for it an unusually rugged, perfectly balanced construction to withstand effectively the vibration encountered in service. At medium speed, with a short stroke, the new screen will operate betwen 350 and 400 r.p.m.

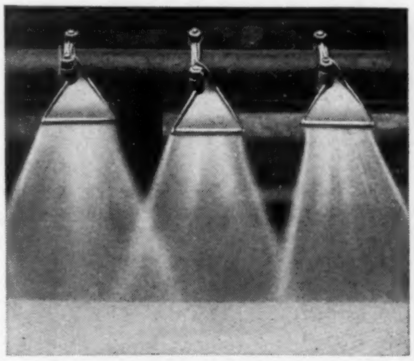
The level-construction feature of this screen, it is claimed, will permit installation on any flat foundation and eliminate special inclined supports. It may be suspended from overhead. Special patented "hold-down" hooks are a feature included to permit speedy and convenient changing of the screen plates. The eccentric is equipped with a heavy-duty, completely enclosed, spherical roller bearing. All other bearings have been made of hard phosphor bronze and are grease lubricated. The Hendrick screen can be furnished in either two- or three-deck construction, built 3, 3½, 4, or 5 ft. wide, in any desired length up to 20 ft.

Car Puller

FRIDY HOIST AND MACHINERY CO., Mountville, Penn., announces "what it considers the last word" in vertical capstan enclosed type car pullers. They are made in four standard sizes (motor ratings) 7½-, 10-, 15- and 20-hp. The illustration shows the 20-hp. size.

Spray Nozzle

LINK-BELT CO., Chicago, Ill., announces a spray nozzle for washing all kinds of material, which is claimed to be simple, effective and non-clogging. It is described as a scientifically shaped, smoothly polished curved bronze deflector with U-bolt for clamping the deflector securely to water pipe, in such a position that it is just above the orifice (a plain drilled hole) in the wall of the pipe. The width of the deflector permits a comparatively large water jet, and thus allows, it is claimed, fairly large dirt particles to pass through the orifice without clogging it. To assemble the deflector on the pipe, it is placed in proper position over the orifice, and then the hex nuts on the U-bolts are tightened.



Non-clogging spray nozzle

Novel Merchandising Policy

THE Audubon Wire Cloth Corp., Philadelphia, Penn., has announced through its advertising agency, Eugene A. Holland, Philadelphia, a novel method of merchandising. The company is advising all its customers and prospects to wire all inquiries to the company "collect." The two telegraph companies have been authorized to accept night or day letters up to 50 words giving quantity, dimensions, size of opening or mesh and diameter of wire or rod, and other necessary specifications.

Heavy-duty, closed-type car puller

Cement Association Makes Annual Award of Safety Trophies

Chairman John Formally Presents Honors at New York Meeting

AT the annual safety luncheon of the Portland Cement Association, held in connection with the Spring Meeting of the Association in New York on May 19, Chairman J. B. John formally awarded safety honors to member cement mills which operated through the 1935 season without lost time accident.

In doing so, Mr. John, who has headed the accident prevention work of P. C. A. for nearly 10 years, announced that notwithstanding the recent setback in the safety records, a greater number of plants than ever before completed the calendar year without mishap. All of the following received awards:

Winners of the Association Trophy for the First Time

Huron Portland Cement Co., Wyandotte, Mich., plant, of which H. A. Browne is superintendent. Last disqualifying accident, August 30, 1932.

North American Cement Corp., Catskill, N. Y., plant, of which G. A. Witte is manager. Last disqualifying accident, December 9, 1934.

Universal Atlas Cement Co., Hannibal, Mo., plant, of which R. A. Hoffman is general superintendent. Last disqualifying accident, August 1, 1934.

Previous Winners Who Receive Reaward of the Trophy

Alpha Portland Cement Co., Birmingham, Ala., plant, of which H. O. Underhill is manager. Previous awards for perfect records in 1930, 1932, 1933 and 1934.

Alpha Portland Cement Co., Ironton, Ohio, plant, of which F. C. Brownstead is superintendent. Previous awards for perfect records in 1927, 1928, 1929, 1930, 1931 and 1932.

Alpha Portland Cement Co., Jamesville, N. Y., plant, of which E. L. Boyne is superintendent. Previous award for perfect record in 1934.

Alpha Portland Cement Co., LaSalle, Ill., plant, of which G. Lundborg is superintendent. Previous awards for perfect records in 1930 and 1933.

Alpha Portland Cement Co., St. Louis, Mo., plant, of which F. R. Loveridge is superintendent. Previous award for perfect record in 1930.

Ash Grove Lime & Portland Cement Co., Louisville, Neb., plant, of which A. K. Frolich is superintendent. Previous awards for perfect records in 1931, 1932 and 1933.

Canada Cement Co., Ltd., Exshaw, Alberta, plant, of which V. C. Hamilton is superintendent. Previous awards for perfect records in 1928, 1930, 1931, 1932 and 1933.

Canada Cement Co., Ltd., Port Colborne, Ont., plant, of which L. M. McDonald is superintendent. Previous awards for safety records in 1925, 1930, 1931, and 1932.

Cumberland Portland Cement Co., Cowan, Tenn., plant, of which Frank Pearson is secretary-treasurer. Previous award for perfect safety record in 1933.

Dewey Portland Cement Co., Davenport, Ia., plant, of which G. S. Parker is superintendent. Previous award for perfect safety record in 1933.

Diamond Portland Cement Co., Middle Branch, Ohio, plant of which W. W. Kinginger is superintendent. Previous awards for perfect safety records in 1930, 1933 and 1934.

Florida Portland Cement Co., Tampa, Fla., plant, of which George D. Brown is plant superintendent. Previous award for perfect safety record in 1933.

Glens Falls Portland Cement Co., Glens Falls, N. Y., plant, of which Francis L. Bayle is superintendent. Previous award for perfect safety record in 1931.

Great Lakes Portland Cement Corp., Buffalo, N. Y., plant, of which A. T. Bevier is superintendent. Previous awards for perfect safety records in 1929, 1930, 1931, 1933 and 1934.

Hercules Cement Corp., Hercules, Penn., plant, of which J. Stanley Downs is superintendent. Previous awards for perfect safety records in 1929, 1931, 1932 and 1933.

Lehigh Portland Cement Co., Iola, Kan., plant, of which C. A. Swiggett is superintendent. Previous awards for perfect safety records in 1927, 1928, 1929, 1930, 1931, 1932, 1933 and 1934.

Lone Star Cement Corp., Birmingham, Ala., plant, of which I. C. Brotzman is superintendent. Previous awards for perfect safety records in 1929 and 1931.

Lone Star Cement Corp., New Orleans, La., plant, of which A. D. Stancliff is general superintendent. Previous award for perfect safety record in 1929.

Lone Star Cement Corp., Nazareth, Penn., plant, of which E. C. Champion is superintendent. Previous awards for perfect safety records in 1929, 1933 and 1934.

Lone Star Cement Co. New York, Inc., Hudson, N. Y. plant, of which John Norvig is general superintendent. Previous awards for perfect safety records in 1933 and 1934.

Lone Star Cement Co. Texas, Dallas, Tex., plant, of which Wm. Moeller is general superintendent. Previous awards for perfect safety records in 1932 and 1934.

Marquette Cement Manufacturing Co., Cape Girardeau, Mo., plant, of which Robt. Matthews is superintendent. Previous awards for perfect safety records in 1928, 1929 and 1934.

Medusa Portland Cement Co., Bay Bridge, Ohio, plant, of which A. J. Little is superintendent. Previous awards for perfect safety records in 1930 and 1931.

Medusa Portland Cement Co., Toledo, Ohio, plant, of which W. J. Worthy is superintendent. Previous awards for perfect safety records in 1929, 1930, 1931, 1932, 1933 and 1934.

Medusa Portland Cement Co., York (gray), Penn., plant, of which E. E. Whitlatch is superintendent. Previous awards for perfect records in 1929, 1932, 1933 and 1934.

Medusa Portland Cement Co., York (white), Penn., plant, of which E. E. Whitlatch is superintendent. Previous awards for perfect safety records in 1930, 1931, 1932, 1933 and 1934.

Missouri Portland Cement Co., Independence, Mo., plant, of which O. F. Schulzke is superintendent. Previous award for perfect safety record in 1934.

Nebraska Cement Co., Superior, Neb., plant, of which D. C. Coulson is superintendent. Previous awards for perfect safety records in 1933 and 1934.

North American Cement Corp., Howes Cave, N. Y., plant, of which J. W. Campbell is superintendent. Previous awards for perfect safety records in 1930, 1931, 1933 and 1934.

North American Cement Corp., Security, Md., plant, of which Paul H. Leichel is superintendent. Previous award for perfect safety record in 1930.

Pennsylvania-Dixie Cement Corp., Kingsport, Tenn., plant, of which Norman V. Geyer is superintendent. Previous awards for perfect safety records in 1930 and 1932.

Pennsylvania-Dixie Cement Corp., Clinchfield, Ga., plant, of which E. P. Newhard is superintendent. Previous awards for perfect safety records in 1932 and 1934.

Pennsylvania-Dixie Cement Corp., Nazareth, Penn., plant, of which Floyd Walters is superintendent. Previous awards for perfect safety records in 1930 and 1933.

Pennsylvania-Dixie Cement Corp., Portland Point, N. Y., plant, of which F. P. Werner is superintendent. Previous awards for perfect safety records in 1930, 1932, 1933 and 1934.

Pittsburgh Plate Glass Co., Fultonham, Ohio, plant, of which R. W. McAllister is superintendent. Previous awards for perfect record in 1931.

Southwestern Portland Cement Co., Osborn, Ohio, plant, of which J. E. Velzy is superintendent. Previous awards for perfect safety records in 1931, 1933 and 1934.

Standard Portland Cement Co., Painesville, Ohio, plant, of which Harold Stevens is superintendent. Previous award for perfect safety record in 1934.

Universal Atlas Cement Co., Independence, Kan., plant, of which C. M. Carman is superintendent. Previous awards for perfect safety records for years 1931, 1932 and 1933.

Universal Atlas Cement Co., Leeds, Ala., plant, of which L. M. Funderberg is superintendent. Previous awards for perfect safety records in 1931 and 1932.

Universal Atlas Cement Co., Universal, Penn., plant, of which R. L. Slocum is superintendent. Previous awards for perfect safety records in 1930, 1932, 1933 and 1934.

Not Expanding

Missouri Portland Cement Co., St. Louis, Mo., in a communication addressed to the Tulsa, Okla., Chamber of Commerce, states that it has no immediate plans to go ahead with the construction of a cement plant there because the cement industry operated last year to only 30.5% of its manufacturing capacity. The telegram was read at a recent meeting of the chamber's directors. This is the project referred to on p. 55, ROCK PRODUCTS, June, 1936, issue. It was originally promoted under the name Mid-Continental Cement Corp.

New Equipment

Lone Star Cement Co., New York, Hudson, N. Y., is reported to be installing two new 16-ft. Bradley air separators on raw and finish mills.

Hires Advertising Agency

Ohio Hydrate and Supply Co., Woodville, Ohio, has appointed the United States Advertising Corp., Toledo, Ohio, as advertising counsel. Plans call for business-paper advertising and special sales promotion and merchandizing campaigns.

THE INDUSTRY

New Incorporations

Edgewater Stone Co., Edgewater, N. J.; 250 shares, no par value. Agent is Fred Lahm.

Standard Silica Sand Co., Inc., Hackensack, N. J.; capital, $125,000. Agent, Warren C. Banta.

Columbia Bottom Quarry, Inc., Baden Station, Mo. Incorporators are Jerome Flynn and John Guerra.

Hermann Silica Sand Co., Hermann, Mo.; capital $50,000. Incorporators are C. A. Riek and F. J. McFlynn.

The Ohio Hydraulic Stone Co., Cleveland, Ohio; $40,000 and 3000 shares no par; Seidman & Seidman, 726 Hickox Bldg.

Dalrymple Gravel and Contracting Co., Inc., Southport, N. Y.; to deal in sand and gravel; $25,000; Gardner & Moseson, Elmira, N. Y.

Valley Dolomite Corp., St. Louis, Mo.; capital $300,000. Incorporators are Ben P. Williams, 528 W. Polo Drive, and Charles M. Day.

Anacache Rock Asphalt Co., St. Louis, Mo.; capital $100,000. Incorporators are Frederick H. Coester and Kingsley E. Bryant, 6258 Enright Ave.

The Killbuck Sand and Gravel Co., Killbuck, Ohio; 250 shares, no par. Incorporators are Ethel Purdy, S. W. Purdy, W. W. Purdy, Reba Purdy and V. W. Purdy.

Topsfield Sand & Gravel Co., Foxboro, Mass.; 100 shares common, no par value. Incorporators are Joseph Cantone, Pasquale Leonardi and Wallace E. Long.

Turow-Wallace, Inc., Milwaukee, Wis.; to deal in sands; 50 shares, no par value. Incorporators are Mabel Erickson, Charles Turow and William K. Wallace.

Hertz Sand and Gravel Co., Stamford, Conn.; capital, $50,000; commencing business, $10,000; par, $100. Incorporators are Clarence E. Hertz, William E. Allen and Mary E. Kravutske.

Sylvan Crest Sand and Gravel Co., Bridgeport, Conn.; capital $50,000; commencing business $5000 par $100. Incorporators are Nicholas D'Addario, Anna M. Peck and Zoltan Burger.

New England Fluorspar Co., Boston, Mass.; to operate mining properties; 900 common shares no par value. Incorporators are William Spence Black, Jonathan Jackson and Edward G. Fischer.

The Baker Concrete Pipe Co. (formerly the Enid Concrete Pipe and Stone Co.), Bethany, Okla.; capital stock, $160,000. Incorporators are E. W. Baker, L. J. Baker and W. L. McManus, Oklahoma City, Okla.

Aged Lime and Sand Co., 160 N. La Salle St., Chicago, Ill.; general construction and trucking business; 200 shares, p.v. common. Incorporators are Adele Z. Rocco, Margaret Holsinger and Harold J. Hopkinson.

Arrow Fluorspar Corp., 10 S. La Salle St., Chicago, Ill.; to deal in ores, metals and minerals; 100 shares p.v. preferred and 100 shares no par value common. Incorporators are J. R. Finkelstein, M. T. Brown and T. Leonard Magee.

Black Hawk Material Co., Waterloo, Iowa; to produce and deal in construction materials for buildings and highways; capital stock authorized, $10,000; par value $100 per share. Incorporators are J. A. Young, Carleton Sias and M. E. Sorenson.

Southwestern Construction Co., Red Oak, Iowa; to operate stone quarries and gravel and sand pits and to do a general contracting and construction business; authorized capital $10,000, divided into 200 shares common stock of $50 par value. Incorporators are J. L. Campbell, F. M. Carpenter and James C. Patterson.

Golden Sand and Gravel Co., Golden, Miss.; to mine, quarry, manufacture and deal in sand, gravel, stone and other minerals; 3200 shares of common stock authorized, at $10 a share. Incorporators are Gilbert J. Bach, 4240 Greenview Ave., Chicago, Ill.; C. D. Carter, Sheffield, Ala.; and Walter P. Peyson, 906 Addison St., Chicago, Ill.

Personals

Chester A. Brooke, sales manager of the Monarch Cement Co., Humbolt, Kan., has been re-elected a director-at-large of the State Chamber of Commerce. He had just finished a three-year term, in which he took active part in the affairs of the organization.

Stanley M. Mercier

Stanley M. Mercier, for many years identified with sales, engineering, and construction of conveying systems for the Jeffrey Mfg. Co., Columbus, Ohio, has joined the sales and engineering staff of Boston Woven Hose and Rubber Co., Boston, Mass. Mr. Mercier has been in charge of many large installations in all sections of the country, notably the Grand Coulee dam, Fort Peck, the Florida ship canal at Ocala, Fla., and the East Boston, Mass., harbor tunnel.

Joseph F. Potts, Rocky River, Ohio, traffic manager of Kelley Island Lime and Transport Co., has been elected president of the Traffic Club of Cleveland.

George H. Deighton, chemist for the Three Forks Portland Cement Co., Trident, Mont., was married May 31 to Miss Ila Pichette, daughter of Mr. and Mrs. J. A. Pichette, at Great Falls, Mont.

Paul H. McMillin, superintendent of the Roche Harbor Lime and Cement Co., Roche Harbor, Wash., gave a talk on the uses of lime before the Chamber of Commerce at Bellingham, Wash., May 27.

C. G. Knobloch of the National Lime and Stone Co., Findlay, Ohio, was elected, at a recent meeting of the All-Ohio Safety Congress in Columbus, as chairman of quarries, lime and cement, to arrange programs for the 1937 sessions.

Gordon N. Scott of the Pioneer Sand and Gravel Co., Seattle, Wash., has been elected president of the building materials dealers in the Seattle district. **Norman A. Nerdrum** of Salmon Bay Sand and Gravel Co., Seattle, was elected vice-president.

Raymond R. Perine, Albany, N. Y., assistant treasurer and auditor of Lone Star Cement Co., New York, recently moved to New Orleans to become assistant treasurer and secretary of the company's Louisiana subsidiary. He is succeeded in the Albany office by **Arthur F. Flatley.**

F. E. Schundler, general manager of F. E. Schundler & Co., Inc., Long Island City, N. Y., sailed for Europe June 17 with his wife and their niece Miss Laura Sprague. Mr. Schundler will make a survey of the insulation markets of Europe and will do exploration work to develop his company's resources of crude materials.

John P. Sanger, purchasing agent, United States Gypsum Co., Chicago, Ill., won $100—third prize—for a paper he submitted in a contest dealing with the selection of the source of supplies. The award was made at the 21st annual convention of the National Association of Purchasing Agents, meeting in New Orleans, La., May 25.

Raymond R. Weasner, superintendent of the France Stone Co. quarry at Bloomville, Ohio, has been transferred to a similar position at the North Baltimore, Ohio, plant. **Charles Gernert** succeeds him at Bloomville. **Irvin A. Behm,** who has been in charge of the office at Bloomville, has been promoted to superintendent of the Bascom, Ohio, quarry; and **Harold Hiller,** office manager at East Liberty, was transferred to Bloomville to succeed Mr. Behm.

Obituaries

Ferdinand W. Roebling, Jr., president of John A. Roebling's Sons Co., Trenton, N. J., died May 29.

John J. McDonald, 58, of the National Portland Cement Co., Brodhead, Penn., died June 8 of cancer at his home in New York City.

John H. Mutchler, 60, superintendent of Kelley Island Lime Products Co., Gibsonburg, Ohio, died May 26, after a complicated illness.

Warner Moore, 90, died at his home in Richmond, Va., May 26. He was head of Warner Moore & Co., operating the Shockoe Mills, and also was president of the Powahatan Lime Co. and several other concerns. He had purchased the Shockoe Mills, building materials plant, in 1880.

Quarries

Keokuk, Iowa: Plans have been made to reopen the two stone quarries in Lee county closed in May when WPA funds for operation were refused.

Macon, Mo.: The Macon county WPA quarry is working in a double-shift to hurry up the production of rock for roads. About 10 miles of the 80-mile program has been completed.

Columbus City, Iowa: Firemen from Columbus Junction were called to the Louisa county rock quarry May 25 when an explosion of gasoline set fire to the tool sheds. A Diesel tractor, tools and other materials were damaged.

Coffeyville, Kan.: A quarry is being opened east of Elgin for crushing limestone to surface the Elgin-Longton road, a WPA project. The county stone crusher used on the Sedan-Longton road has been repaired for use at the new quarry.

Oskaloosa, Iowa: Mahaska county has signed a ten-year lease for the right to open and operate a rock quarry on the Dick Eveland farm in the northeast corner of Jefferson township. The usual price of 5c a cubic yard will be paid, W. L. Campbell, county superintendent, said. This is the county's third quarry. Activity will start as soon as equipment can be secured, extent of operation depending on how much WPA labor is available.

Sand and Gravel

Saxet Sand and Gravel Co., formerly of Houston, Texas, moved its general offices June 1 to the Nixon Building, Corpus Christi, Texas.

Waseca, Minn.: Waseca county commissioners have voted to invest $10,000 in graveling of state aid roads this summer. Gravel will be taken from the Carl O. Johnson farm in south Otisco.

Maunie Sand and Gravel Co., Grayville, Ill., has purchased a gasoline crane from Cunningham brothers of Sumner, Ill., for use in handling increased business at Maunie. The crane was used in excavation work in the construction of bridge piers at Bonpas creek for the new state highway.

Manufacturers

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., announces election of L. W. Grothaus as vice-president. Mr. Grothaus has been with the firm for 32 years.

Iron & Steel Products, Inc., Chicago, Ill., has purchased the North Works of The Ryan Car Co. in Hegewisch, Ill., and will use the plant in its railway supplies business.

Morris Machine Works, Baldwinsville, N. Y., announces election of Carl Lager as president and Pierce J. McAuliffe as vice-president and general manager. These changes are incident to the death of Windsor Morris.

The Babcock & Wilcox Co., New York, N. Y., has named Edward A. Livingstone manager of alloy tube sales for Babcock & Wilcox Tube Co., Beaver Falls, Penn. Mr. Livingstone has done special sales work for the company since 1933.

The Osgood Co. has changed the location of its Philadelphia, Penn., office to Room 126, Wilford Building, 33rd and Arch Sts. George P. Greene has been transferred from Marion, Ohio, to act as associate to James G. Hoag, district manager, Philadelphia.

Robins Conveying Belt Co., New York, N. Y., has made a sales agreement with the Mine and Smelter Supply Co. of Denver, Colo., Salt Lake City, Utah, and El Paso, Texas, for the sale of Robins equipment in Arizona, Colorado, Montana, New Mexico, Utah and Wyoming and in parts of Idaho, Nebraska, South Dakota and Texas.

Link-Belt Co., Chicago, Ill., announces that J. C. Bloomfield has joined its shovel, dragline, crane sales division to specialize on the application of these machines to railroad service. L. P. Spillan, for many years a member of the department, has been appointed shovel and crane division sales manager in charge of sales to contractors. N. A. Weston has been given charge of shovel division industrial sales in the Chicago district.

The Dorr Co., Inc., New York, N. Y., is moving its headquarters to the General Electric Building, 570 Lexington Ave., effective July 1. With this moving, the company completes the transfer of all major functions, including engineering, to the East. An important feature of the new quarters is a large reference library, open to clients and friends. Research and development will continue to be handled at the Westport Mill, Westport, Conn.

(Patented)

JEFFREY-TRAYLOR ELECTRIC-VIBRATING SCREENS SETTING NEW RECORDS AT PENNSYLVANIA-DIXIE CEMENT CORP.

The Penn-Dixie Cement Corp. at their Richard City, Tenn., Plant replaced two centrifugal slurry separators with four Jeffrey-Traylor electric-vibrating Screens.... and thereby raised the Kominuter output 35 to 40%. Two 4x7 ft. J-T Screens, equipped with 0.045 Rectangular cloth, are operated in closed circuit with each No. 106 Kominuter.

The material as fed to these screens contains 30% water, the screen fines 35% and the tailings 12% water.

The 16 mesh fineness has been raised from 95.8 to 98.2%. This increase in fineness has in turn permitted a noticeable increase in the output of the three 7x27 ft. tube mills.

Thus Jeffrey-Traylor electric vibrated Screens mark a new departure in efficiency, performance, production and profits.

Let us send you complete Catalog covering J-T Units and data on what they will do for you.

Jeffrey-Traylor Division

JEFFREY EQUIPMENT:

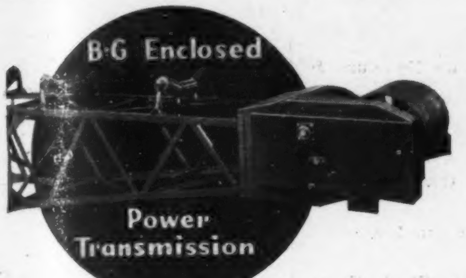
Electric Vibrating Feeders, Screens,
Conveyors, Coolers and Dryers
Crushers, Pulverizers and Shredders
Sand and Gravel Handling Equipment
Bucket Elevators and Conveyors
Chains, Sprockets and Attachments
Sand Settling Tanks

THE JEFFREY MANUFACTURING CO.

935-99 NORTH FOURTH ST. COLUMBUS, OHIO

Via Barber-Greenes

Here are two new Barber-Greenes doing a perfect job in an ideal plant.



The conveyor on the right is 160' long, with a Barber-Greene steel truss 42" deep. This conveyor not only has fairly long spans but carries an 8" water pipe in addition to the walkway.

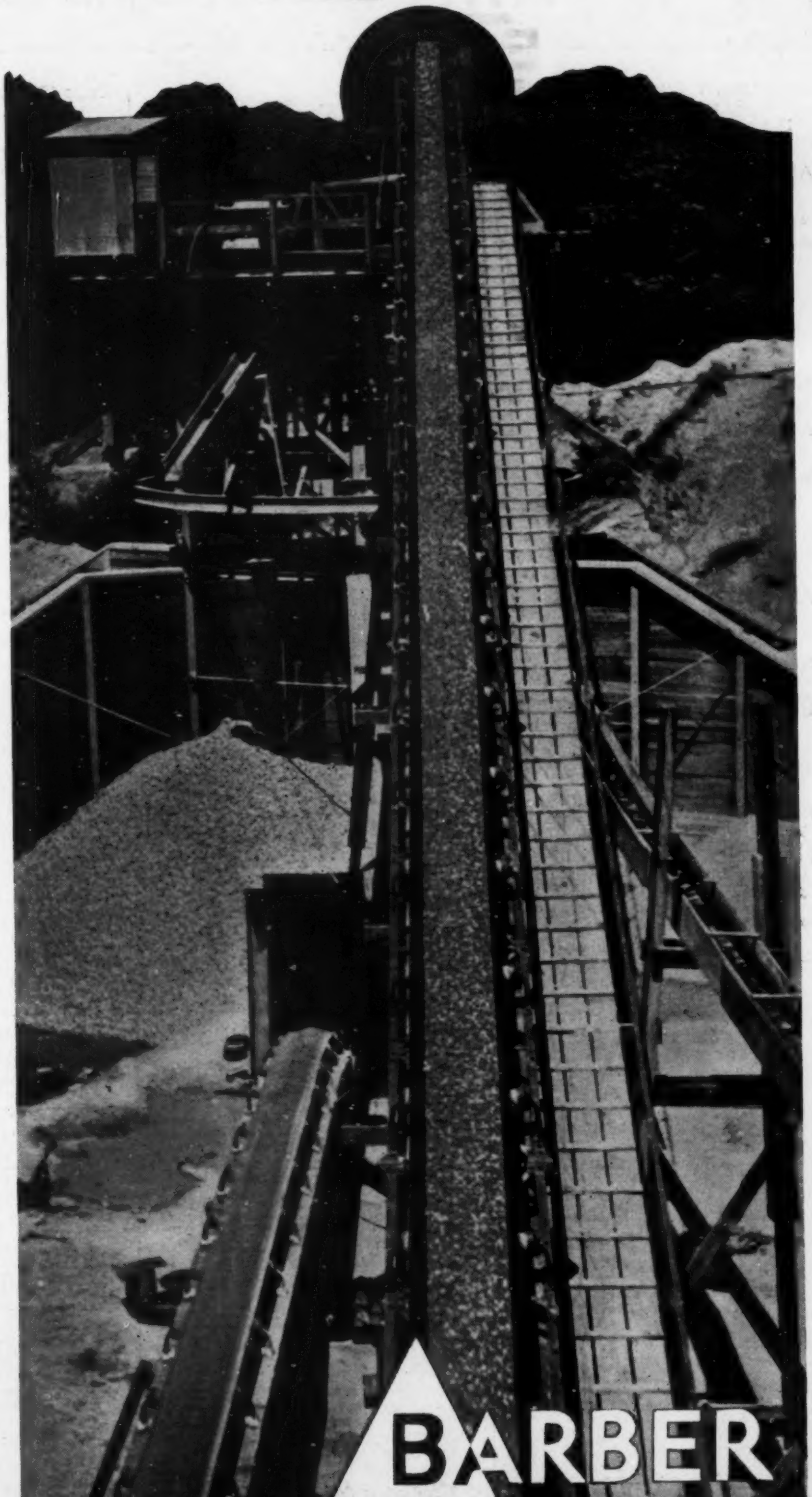
The left conveyor, which runs horizontally just above the ground, is mounted on wood stringers as no long spans are necessary.

Both conveyors are driven by the new Barber-Greene enclosed transmission, an all-welded steel unit, dust tight, internally lubricated. This transmission is available in two sizes, has highest quality anti-friction bearings and precision-made steel gears and sprockets.

The new Barber-Greene 42" deep welded steel truss has all the well known B-G advantages, standardized sectional construction, quick easy erection, etc.

The carriers on both conveyors are the finest made by Barber-Greene: Unbreakable, all-welded steel base, end brackets die formed, oversize Shafer Self-Aligning Roller Bearings. FOUR pass labyrinth grease seals keep the grease in and grit out.

The carriers alone justify your inquiry. Send a card or letter today for full information on Barber-Greene conveyors. Remember we maintain a department for the sole purpose of solving your material handling problems the most efficient, economical way. There is no obligation. ***Barber-Greene Company, 459 West Park Avenue, Aurora, Illinois.***



Classified Directory of Advertisers in this Issue of ROCK PRODUCTS

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Agitators, Thickeners and Slurry Mixers
Dorr Co.
F. L. Smidth & Co.

Airveyor
Fuller Co.

Air Compressors
Curtis Pneumatic Machy. Co.
Fuller Co.
Gardner-Denver Co.
Nordberg Mfg. Co.
F. L. Smidth & Co.
Traylor Eng. & Mfg. Co.
Worthington Pump & Machy. Corp.

Air Filters
Fuller Co.

Air Hoists
Curtis Pneumatic Machy. Co.

Air Separators
Bradley Pulverizer Co.
Raymond Bros. Impact Pulv. Co.
Sturtevant Mill Co.
Universal Road Machy. Co.

Air Tool Hose
Worthington Pump & Machy. Corp.

Applicator Bars
Stulz-Sickles Co.

Babbitt Metal
Joseph T. Ryerson & Son, Inc.

Backfillers
Bucyrus-Erie Co.

Balls, Grinding, (See Grinding Balls)

Balls (Tube Mill, etc.)
Allis-Chalmers Mfg. Co.
Carnegie-Illinois Steel Corp. (United States Steel Corp. Subsidiary)
F. L. Smidth & Co.

Bar Benders and Cutters
Koehring Co.

Batchers
Fuller Company

Bearings
Chain Belt Co.
Link-Belt Co.
Joseph T. Ryerson & Son, Inc.
Timken Roller Bearing Co.

Bearings (Anti-Friction)
Timken Roller Bearing Co.

Bearings (Roller)
Timken Roller Bearing Co.

Bearings (Tapered Roller)
Timken Roller Bearing Co.

Bearings (Thrust)
Timken Roller Bearing Co.

Belt Fasteners
Flexible Steel Lacing Co.

Belt Lacing (Steel)
Flexible Steel Lacing Co.

Belting
Hewitt Rubber Corp.

Belting (Elevator and Conveyor)
Hewitt Rubber Corp.

Belting (Metal, Conveyor, High and Low Temperature)
Wickwire Spencer Steel Co.

Belting (Transmission)
Hewitt Rubber Corp.

Bin-Dicater
Bin-Dicator Co.

Bin Gates
Chain Belt Co.
Fuller Co.
Link-Belt Co.
Sprout, Waldron & Co., Inc.
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.

Bins
Blaw-Knox Co.
Traylor Eng. & Mfg. Co
Universal Road Machy. Co.

Blasting Machines
Atlas Powder Co.
E. I. du Pont de Nemours & Co., Inc.

Blasting Supplies
Atlas Powder Co.
E. I. du Pont de Nemours & Co., Inc.

Blasting Powder (See Powder, Blasting)

Blocks (Pillow, Roller Bearing)
Link-Belt Co.
Timken Roller Bearing Co.

Blocks (Sheave)
American Manganese Steel Co.

Bodies (Car & Motor Truck)
Easton Car & Construction Co.

Boilers
Babcock & Wilcox Co.

Breakers (Primary)
Smith Engineering Works
Williams Patent Crusher & Pulv. Co.

Bucket Dumps
Dempster Bros., Inc.

Buckets (Clamshell, Grab, Orange Peel, etc.)
Blaw-Knox Co.
Hayward Company
Link-Belt Co.
Owen Bucket Co.
Wellman Eng. Co. (G. H. Williams)

Buckets (Dragline and Slackline)
American Manganese Steel Co.
Blaw-Knox Co.
Bucyrus-Erie Co.
Owen Bucket Co.
Page Engineering Co.
Wellman Eng. Co. (G. H. Williams)

Buckets (Dredging and Excavating)
Owen Bucket Co.

Buckets (Elevator and Conveyor)
Chain Belt Co.
Cross Engineering Co.
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.

Buggies (Dump)
R. G. Le Tourneau, Inc.

Bulldozers
Blaw-Knox Co.
Koehring Co.
R. G. Le Tourneau, Inc.

Cableways
Broderick & Bascom Rope Co.
Link-Belt Co.
Macwhyte Co.
Williamsport Wire Rope Co.

Calcinators
Bradley Pulverizer Co.

Calcining Kettles (Gypsum)
J. B. Ehrsam & Sons Mfg. Co.

Cap Crimpers and Fuse Cutters
Ensign-Bickford Co.

Caps (Blasting)
Atlas Powder Co.
E. I. du Pont de Nemours & Co., Inc.

Car Pullers
Link-Belt Co.

Carriers
Barber-Greene Co.

Carryalls
R. G. Le Tourneau, Inc.

Cars (Dump)
Carnegie-Illinois Steel Corp. (United States Steel Corp. Subsidiary)

Cars (Quarry & Gravel Pit)
Carnegie-Illinois Steel Corp. (United States Steel Corp. Subsidiary)
Easton Car & Construction Co.

Castings
Babcock & Wilcox Co.
Eagle Iron Works (Grey Iron)
Link-Belt Co.
Timken Roller Bearing Co.

Cement Making Machinery
F. L. Smidth & Co.

Cement Process
Cement Process Corp.

Cement Pumps
Fuller Co.
F. L. Smidth & Co.

Central Mixing Plants
Blaw-Knox Co.
Chain Belt Co. (Concrete)

Chain (Dredge and Steam Shovel)
Bucyrus-Erie Co.
Jeffrey Mfg. Co.

Chain (Elevating and Conveying)
American Manganese Steel Co.
Chain Belt Co.
Link-Belt Co.

Chain Drives
Chain Belt Co.

Chain Systems (Kilns)
F. L. Smidth & Co.

Chutes and Chute Liners
American Manganese Steel Co.
Cross Engineering Co.

Clarifiers
Dorr Co.
Hardinge Co., Inc.

Classifiers
Dorr Co.
Hardinge Co., Inc.
Link-Belt Co.

Clay Working Machinery
Bonnot Company

Clips (Wire Rope)
Broderick & Bascom Rope Co.
Macwhyte Co.
Williamsport Wire Rope Co.

Coal Crushers and Rolls
Williams Patent Crusher & Pulv. Co.

Coal Pulverizing Equipment
Babcock & Wilcox Co.
Bonnot Company
Bradley Pulverizer Co.
Gruendler Crusher & Pulv. Co.
Pennsylvania Crusher Co.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.
Williams Patent Crusher & Pulv. Co.

Compressed Air Hoists
Gardner-Denver Co.

Compressed Air Rock Drills
Cleveland Rock Drill Co.
Gardner-Denver Co.

Compressors (See Air Compressors)

Concentrators (Slurry, etc.)
Dorr Co.

Concrete Pipe Machinery
Universal Concrete Pipe Co.

Concrete Slab Raising Equipment (Mud-Jack)
Koehring Co.

Conveyor Belting (See Belting)

Conveyor Idlers and Rolls
Barber-Greene Co.
Chain Belt Co.
Link-Belt Co.

Conveyors and Elevators
Earle C. Bacon, Inc.
Barber-Greene Co.
Chain Belt Co.
Fuller Company
Jeffrey Mfg. Co. (Vibrating)
Lewistown Fdy. & Mach. Co.
Link-Belt Co.
Robins Conveying Belt Co.
F. L. Smidth & Co.
Smith Engineering Works
Sturtevant Mill Co.
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.

Conveyors (Pneumatic)
Fuller Company

Conveyors (Screw)
Link-Belt Co.

Coolers (See Kilns and Coolers, Rotary)

Correcting Basins
F. L. Smidth & Co.

Couplings (Air Hose)
Cleveland Rock Drill Co.

Couplings (Flexible and Shaft)
Chain Belt Co.
Link-Belt Co.

Couplings (Hose, Pipe, etc.)
Hewitt Rubber Corp.

Cranes (Air Powered)
Curtis Pneumatic Machy. Co.

Cranes (Clamshell)
Bucyrus-Erie Co.
Koehring Co.

Cranes (Crawler and Locomotive)
Bucyrus-Erie Co.
Koehring Co.
Link-Belt Co.
Northwest Engineering Co.

Cranes (Excavator)
Koehring Co.

Crusher Parts
American Manganese Steel Co.
American Pulverizer Co.
Pennsylvania Crusher Co.

Crushers (Hammer)
American Pulverizer Co.
Carnegie-Illinois Steel Corp. (United States Steel Corp. Subsidiary)
Dixie Machy. Mfg. Co.
Gruendler Crusher & Pulv. Co.
Jeffrey Mfg. Co.
Pennsylvania Crusher Co.
Sturtevant Mill Co.
Williams Patent Crusher & Pulv. Co.

Behind the Quality of

GULF LUBRICANTS

is the world's most modern petroleum research laboratory

WHAT is the rate of oxidation of an oil? What chemical changes take place in an oil under severe service? What is the best oil for a particular type of bearing?

Gulf scientists are finding the answers to these and thousands of other questions regarding lubricants in Gulf's modern research laboratory shown below. Many types of experimental machines duplicate the conditions under which oils perform in actual service.

Thus, the knowledge gained by many years of practical experience in thousands of industrial plants throughout 28 states in lubricating machinery of every type can be supplemented with newly discovered facts. And the user of Gulf lubricants is assured that *when science develops improved petroleum products* they will be available to him.

(*Above*) A new machine developed by Gulf engineers—the first that will test any type of bearing under precisely the operating conditions of actual service. It measures accurately friction, torque, temperature, wear and film thickness.

(*Right*) This complicated apparatus is used to study the behavior of oils at high temperatures in the presence of oxygen. Oils deteriorate rapidly under these conditions, forming organic acids, insoluble sludges and soluble impurities of high viscosity. Samples of the oil are withdrawn at frequent intervals for test, and the changes measured. Gulf oils have highest resistance to such deterioration.

(*Below*) A night view of the new laboratory of the Gulf Research & Development Corporation near Pittsburgh, Pa. In this laboratory are many machines and apparatus of various types which test lubricants under operating conditions similar to those encountered in actual service.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION—GULF REFINING COMPANY

GENERAL OFFICES: GULF BLDG., PITTSBURGH, PA.

Classified Directory—*Continued*

Crushers (Jaw and Gyratory)
Allis-Chalmers Mfg. Co.
Earle C. Bacon, Inc.
Birdsboro Steel Foundry & Mach. Co.
C. G. Buchanan Co., Inc.
Jeffrey Mfg. Co.
Lewistown Fdy. & Mach. Co. (Jaw)
Nordberg Mfg. Co.
Pennsylvania Crusher Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.

Crushers (Reduction)
Bonnot Company
Jeffrey Mfg. Co.

Crushers (Ring)
American Pulverizer Co.

Crushers (Roll)
American Pulverizer Co.
Gruendler Crusher & Pulv. Co.

Crushers (Rotary)
American Pulverizer Co.
J. B. Ehrsam & Sons Mfg. Co.

Crushers (Single Roll)
Gruendler Crusher & Pulv. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
McLanahan & Stone Corp.
Pennsylvania Crusher Co.

Crushing Rolls
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Birdsboro Steel Foundry & Mach. Co.
C. G. Buchanan Co., Inc.
Jeffrey Mfg. Co.
Sturtevant Mill Co.
Traylor Eng. & Mfg. Co.

Cupolas (Rock Wool)
Whiting Corp.

Dedusters
Blaw-Knox Co.

Detonators
Atlas Powder Co.
E. I. du Pont de Nemours & Co., Inc.

Dewatering Machines
Dorr Co.

Dippers (Manganese Steel)
American Manganese Steel Co.

Dippers and Teeth (Steam Shovel)
American Manganese Steel Co.
Bucyrus-Erie Co.
The Frog, Switch & Mfg. Co.

Dirt Moving Equipt. (Dumptor)
Koehring Co.

Ditchers
Barber-Greene Co.
Bucyrus-Erie Co.

Draglines
Bucyrus-Erie Co.
Link-Belt Co.

Draglines (Gasoline or Electric)
Koehring Co.
Northwest Engineering Co.
Page Engineering Co.

Dragline Excavators
Bucyrus-Erie Co.
Northwest Engineering Co.
Page Engineering Co.

Dragline Cableway Excavators
Bucyrus-Erie Co.
Link-Belt Co.
Sauerman Bros.

Dredge Pumps (See Pumps, Dredging)

Dredges
Bucyrus-Erie Co.
Hayward Co.
Hetherington & Berner, Inc.
Morris Machine Works

Drill Bits
Timken Roller Bearing Co.

Drill Sharpening Machines
Gardner-Denver Co.

Drill Sharpening Service
A. Courchesne, Inc.

Drill Steel
Cleveland Rock Drill Co.
Worthington Pump & Machy. Corp.

Drilling Accessories
Cleveland Rock Drill Co.

Drills
Bucyrus-Erie Co.
Timken Roller Bearing Co.

Drills (Blast Hole)
Worthington Pump & Machy. Corp.

Drills, Hammer (See Hammer Drills)

Drills (Rock)
Cleveland Rock Drill Co.
A. Courchesne, Inc.
Gardner-Denver Co.
Worthington Pump & Machy. Corp.

Drills (Tripod)
Cleveland Rock Drill Co.

Drills (Wagon)
Cleveland Rock Drill Co.

Drives (Short Center)
Allis-Chalmers Mfg. Co.

Dryers
Allis-Chalmers Mfg. Co.
Babcock & Wilcox Co.
Bonnot Company
Hardinge Company, Inc.
Traylor Eng. & Mfg. Co.

Dumptors
Koehring Co.

Dust Collecting Systems
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.

Dust Conveying Systems
Fuller Company

Dynamite
Atlas Powder Co.
E. I. du Pont de Nemours & Co., Inc.

Electric Mine Hoists
Nordberg Mfg. Co.

Electric Power Equipment
Allis-Chalmers Mfg. Co.

Elevator Belting (See Belting)

Emery Mills
Sturtevant Mill Co.

Engineers
Bonnot Company
Dorr Co.
Fuller Co.
Hetherington & Berner, Inc.
Kritzer Co.
Productive Equipment Corp.
F. L. Smidth & Co.
Sturtevant Mill Co.

Engines (Diesel)
Nordberg Mfg. Co.
Worthington Pump & Machy. Corp.

Engines (Gasoline, Kerosene and Oil)
Worthington Pump & Machy. Corp.

Engines (Steam)
Morris Machine Works

Excavating Machinery (See Shovels, Cranes, Buckets, etc.)

Excavators (Crawling Tractor)
Koehring Co.

Excavators (Dragline)
Koehring Co.

Explosives
Atlas Powder Co.
E. I. du Pont de Nemours & Co., Inc.

Fans (Exhaust)
Jeffrey Mfg. Co.

Feeders
Babcock & Wilcox Co. (Pulverized Coal)
Chain Belt Co.
Fuller Co. (Cement and Pulverized Material)
Hardinge Company, Inc. (Weighing)
Jeffrey Mfg. Co. (Pan and Tube)
Smith Engineering Works (Plate)

Forges (Oil)
Gardner-Denver Co.

Fuses (Detonating and Safety)
Ensign-Bickford Co.

Galvanized Wire Strand
Macwhyte Co.

Gaskets
Hewitt Rubber Corp.

Gasoline
Socony-Vacuum Oil Co., Inc.
Texas Company

Gears (Spur, Helical & Worm)
Jeffrey Mfg. Co.

Gears and Pinions
Chain Belt Co.
Link-Belt Co.

Gelatin and Semi-Gelatin (See Explosives)

Grapples
Blaw-Knox Co.
Owen Bucket Co.

Grease
Gulf Refining Co.
Socony-Vacuum Oil Co.
Texas Company

Grinding Balls
Babcock & Wilcox Co.
Carnegie-Illinois Steel Corp. (United States Steel Corp. Subsidiary)

Grizzlies
American Manganese Steel Co.
Jeffrey Mfg. Co. (Vibrating)
Productive Equipment Corp.
Smith Engineering Works
Traylor Eng. & Mfg. Co.

Grizzly Feeders
Jeffrey Mfg. Co.
Traylor Eng. & Mfg. Co.

Gypsum Plaster Plants
J. B. Ehrsam & Sons Mfg. Co.

Hammer Drills
Cleveland Rock Drill Co.
Gardner-Denver Co.
Worthington Pump & Machy. Corp.

Hammer Mills (See Crushers)

Hoists
Curtis Pneumatic Machy. Co.
Gardner-Denver Co.
Link-Belt Co.
Northwest Engineering Co.

Hose (Water, Steam, Air Drill, Pneumatic, Sand Suction and Discharge)
Cleveland Rock Drill Co.
Hewitt Rubber Corp.
Macwhyte Co.

Hydrators
Blaw-Knox Co.
Kritzer Co.

I-Beam Trolleys
Curtis Pneumatic Machy. Co.

Indicators (Bin)
Bin-Dicator Co.

Kilns and Coolers (Rotary)
Allis-Chalmers Mfg. Co.
Blaw-Knox Co.
Bonnot Company
F. L. Smidth & Co.
Traylor Eng. & Mfg. Co.

Kominuters (See Mills)

Laboratory Crushers
Sturtevant Mill Co.

Lamp Guards
Flexible Steel Lacing Co.

Lighters, Hot Wire (For Safety Fuse)
Ensign-Bickford Co.

Lime Handling Equipment
Fuller Company
Kritzer Co.
Link-Belt Co.
Raymond Bros. Impact Pulv. Co.

Lime Kilns (See Kilns and Coolers, Rotary)

Linings (Iron for Ball and Tube Mills) (See Mill Liners)

Loaders and Unloaders
Barber-Greene Co.
Bucyrus-Erie Co.
Fuller Company
Jeffrey Mfg. Co.
Link-Belt Co.
Northwest Engineering Co.
Universal Road Machy. Co.

Locomotive Cranes (See Cranes, Crawler and Locomotive)

Locomotives (Electric)
Jeffrey Mfg. Co.

Locomotives (Geared)
Lima Locomotive Works, Inc.

Locomotives (Steam, Gas and Electric)
Lima Locomotive Works, Inc.

Locomotives (Storage Battery)
Jeffrey Mfg. Co.

Log Washer
McLanahan & Stone Corp.
Smith Engineering Works

Lubricants
Broderick & Bascom Rope Co. (Wire Rope)
Gulf Refining Co.
Macwhyte Co.
Socony-Vacuum Oil Co.
Texas Company

Machinery Guards
Harrington & King Perforating Co.

Magnetic Pulleys
Birdsboro Steel Foundry & Mach. Co.
C. G. Buchanan Co., Inc.

Manganese Steel Castings
American Manganese Steel Co.
The Frog, Switch & Mfg. Co.

Manganese Steel Parts
American Manganese Steel Co.

Mill Liners and Linings (Iron for Ball and Tube Mills)
Babcock & Wilcox Co.
Carnegie-Illinois Steel Corp. (United States Steel Corp. Subsidiary)
F. L. Smidth & Co.

Mills, Grinding (Ball, Tube, etc.) (See also Crushers, Hammer)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Bonnot Company
Bradley Pulverizer Co.
Gruendler Crusher & Pulv. Co.
Hardinge Co., Inc.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.
Traylor Eng. & Mfg. Co.
Williams Patent Crusher & Pulv. Co.

Mine Car Hitchings
Macwhyte Co.

Mine Handling Equipment
Chain Belt Co.

Mixers (Commercial Concrete)
Jaeger Machine Co.

Mixers (Concrete)
Gruendler Crusher & Pulv. Co.
Koehring Co.

Motors and Generators (Electric Units)
Allis-Chalmers Mfg. Co.

Nitramon
E. I. du Pont de Nemours & Co., Inc.

Nozzles (Gravel Washing)
Chain Belt Co.

Oil Burners
Babcock & Wilcox Co.
F. L. Smidth & Co.

Oils (Lubricating)
Gulf Refining Co.
Socony-Vacuum Oil Co.
Texas Company

Overhead Traveling Cranes
Curtis Pneumatic Machy. Co.

Packings (Pump, Valve, etc.)
Hewitt Rubber Corp.

Paint (Asphalt)
Texas Company

Classified Directory—*Continued*

Pavers (Concrete)
Koehring Co.

Perforated Metal
Chicago Perforating Co.
Cross Engineering Co.
Harrington & King Perforating Co.
Hendrick Mfg. Co.
Wickwire Spencer Steel Co.

Pipe Molds (Concrete)
Universal Concrete Pipe Co.

Plaster Board and Wallboard Equipment
J. B. Ehrsam & Sons Mfg. Co.

Plates (Double Corrugated)
Hendrick Mfg. Co.

Pneumatic Drills (See Drills)

Portable Compressors
Worthington Pump & Machy. Corp.

Portable Conveyors
Barber-Greene Co.
Fuller Company
Link-Belt Co.

Portable Crushing and Screening Unit
Smith Engineering Works
Williams Patent Crusher & Pulv. Co.

Powder (Blasting)
Atlas Powder Co.
E. I. du Pont de Nemours & Co., Inc.

Pulleys, Magnetic (See Magnetic Pulleys)

Pulverators
Allis-Chalmers Mfg. Co.

Pulverizers (See also Crushers, Mills, etc.)
Allis-Chalmers Mfg. Co.
American Pulverizer Co.
Babcock & Wilcox Co.
Bonnot Company
Bradley Pulverizer Co.
Dixie Machy. Mfg. Co.
Gruendler Crusher & Pulv. Co.
Jeffrey Mfg. Co.
Pennsylvania Crusher Co.
Raymond Bros. Impact Pulv. Co.
F. L. Smidth & Co.
Sturtevant Mill Co.
Universal Road Machy. Co.
Williams Patent Crusher & Pulv. Co.

Pulverizer Parts
American Manganese Steel Co.

Pumps (Air Lift)
Fuller Company

Pumps (Cement)
Fuller Company

Pumps (Cement Slurry)
American Manganese Steel Co.
Morris Machine Works
F. L. Smidth & Co.
A. R. Wilfley & Sons

Pumps (Centrifugal)
Allis-Chalmers Mfg. Co.
Hetherington & Berner, Inc.
Morris Machine Works
A. R. Wilfley & Sons
Worthington Pump & Machy. Corp.

Pumps (Dredging)
American Manganese Steel Co.
Bucyrus-Erie Co.
Morris Machine Works
Worthington Pump & Machy. Corp.

Pumps (Pulverized Coal)
Babcock & Wilcox Co.

Pumps (Sand and Gravel)
Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Hetherington & Berner, Inc.
Morris Machine Works
A. R. Wilfley & Sons

Quarry Bars
Worthington Pump & Machy. Corp.

Quarry Cars
Easton Car & Construction Co.

Ready Mixed Concrete (Truck Mixer Bodies)
Blaw-Knox Co.
Chain Belt Co.

Ready Mixed Concrete Plants
Blaw-Knox Co.

Reinforcement Fabric (Concrete)
Wickwire Spencer Steel Co.

Road Machinery
Barber-Greene Co.
Blaw-Knox Co.
Koehring Co.
Northwest Engineering Co.

Rock Bits (See Drill Bits)

Rock Drills (See Drills, Rock)

Rock Wool Machinery
Whiting Corp.

Rod Mills
Traylor Eng. & Mfg. Co.

Rods (Wire)
Wickwire Spencer Steel Co.

Roller Bearings
Timken Roller Bearing Co.

Roofing (Ready to Lay)
Texas Company

Roofing and Siding (Steel)
Joseph T. Ryerson & Son, Inc.

Rope, Wire (See Wire Rope)

Sand Drag
Smith Engineering Works

Sand and Gravel Handling Equipt.
Sprout, Waldron & Co., Inc.

Sand and Gravel Screening & Washing Equipt.
Universal Road Machy. Co.

Sand Settling Tanks
Link-Belt Co.
Smith Engineering Works

Scrapers (Power Drag)
Blaw-Knox Co.
Link-Belt Co.
Northwest Engineering Co.
Sauerman Bros.

Screens
Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Audubon Wire Cloth Corp.
Earle C. Bacon, Inc.
Carnegie-Illinois Steel Corp. (United States Steel Corp. Subsidiary)
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
Cross Engineering Co.
Harrington & King Perf. Co.
Hendrick Mfg. Co.
Jeffrey Mfg. Co.
Link-Belt Co.
National Wire Cloth Co.
Nordberg Mfg. Co.
Simplicity Eng. Co.
Smith Engineering Works
Sturtevant Mill Co.
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.
Universal Vibrating Screen Co.

Screens, Scalping (Hercules and Standard)
Smith Engineering Works

Screens (Vibrating)
Link-Belt Co.
Nordberg Mfg. Co.
Robins Conveying Belt Co.
Simplicity Eng. Co.
Smith Engineering Works
Sturtevant Mill Co.
W. S. Tyler Co.
Williams Patent Crusher & Pulv. Co.

Screens, Washing (Hercules, Ajax and Standard)
Smith Engineering Works

Screens (Woven Wire)
Wickwire Spencer Steel Co.

Screw Rewasher (Single and Twin)
Smith Engineering Works

Scrubbers, Washers
Allis-Chalmers Mfg. Co.
Hardinge Company, Inc.
Smith Engineering Works

Seal Rings
Traylor Eng. & Mfg. Co.

Separators (Magnetic)
Birdsboro Steel Foundry & Mach. Co.
C. G. Buchanan Co., Inc.

Separators (Slurry)
F. L. Smidth & Co.

Shovels, Power (Steam, Gas, Electric, Diesel, Oil)
Bucyrus-Erie Co.
Koehring Co.
Link-Belt Co.
Northwest Engineering Co.

Silos
F. L. Smidth & Co.

Skip Hoists and Skips
Link-Belt Co.

Slings (Wire Rope)
American Cable Co.
A. Leschen & Sons Rope Co.
Macwhyte Co.
Williamsport Wire Rope Co.

Sockets (Wire Rope)
Macwhyte Co.

Speed Reducers
Link-Belt Co.
Traylor Eng. & Mfg. Co.

Springs (Extension, Compression, Torsion or Flat)
Wickwire Spencer Steel Co.

Sprockets and Chain
Chain Belt Co.
Jeffrey Mfg. Co.

Steam Shovel Repair Parts
American Manganese Steel Co.

Steel (Abrasion Resisting)
Joseph T. Ryerson & Son, Inc.

Steel Bars
Timken Roller Bearing Co.

Steel (Bars, Shapes, Plates, etc.)
Joseph T. Ryerson & Son, Inc.

Steel (Electric Furnace)
Timken Roller Bearing Co.

Steel (Open Hearth)
Timken Roller Bearing Co.

Steel (Special Alloy)
Timken Roller Bearing Co.

Steel (Special Analysis)
Timken Roller Bearing Co.

Steels, Drill (See Drill Steel)

Stokers
Babcock & Wilcox Co.

Tanks
Dorr Co.
Link-Belt Co.
Worthington Pump & Machy. Corp.

Thickeners
Dorr Co.

Thimbles
Macwhyte Co.

Track Equipment
Carnegie-Illinois Steel Corp. (United States Steel Corp. Subsidiary)
Nordberg Mfg. Co.

Track Shifters
Nordberg Mfg. Co.

Tractors
Koehring Co.

Tramways (Aerial Wire Rope)
Broderick & Bascom Rope Co.
A. Leschen & Sons Rope Co.
Macwhyte Co.
Williamsport Wire Rope Co.

Transmission Belting (See Belting)

Transmission Machinery
Allis-Chalmers Mfg. Co.
Kritzer Co.
Timken Roller Bearing Co.

Trenchers
Barber-Greene Co.

Truck Bodies (Dump)
Easton Car & Construction Co.

Truck Bodies (Ready Mixed Concrete)
Blaw-Knox Co.
Jaeger Machine Co.

Trucks (Mixers)
Blaw-Knox Co.
Jaeger Machine Co.

Trukmixers
Blaw-Knox Co.

Tube Mills (See Mills, Ball, Tube, etc.)

Tube Mill Liners (See Mill Liners)

Tubing (Seamless Steel)
Timken Roller Bearing Co.

Turnbuckles
Macwhyte Co.

Underground Shovels
Nordberg Mfg. Co.

Valves (Air)
Cleveland Rock Drill Co.

Valves (Pump)
Worthington Pump & Machy. Corp.

Vibrating Screens (See Screens, Vibrating)

Wagons (Dump)
R. G. Le Tourneau, Inc.

Washers (Sand, Gravel and Stone)
Allis-Chalmers Mfg. Co.
Dorr Co.
Eagle Iron Works
Gruendler Crusher & Pulv. Co.
Link-Belt Co.
Traylor Eng. & Mfg. Co.
Universal Road Machy. Corp.

Weigh-Mix
Koehring Co.

Welding Electrodes (Nickel Manganese Steel)
Stulz-Sickles Co.

Welding Rod
Joseph T. Ryerson & Son, Inc.

Wire (Flat, Round, Square or Special Shapes)
Wickwire Spencer Steel Co.

Wire (Piano and Music)
Wickwire Spencer Steel Co.

Wire Cloth
Audubon Wire Cloth Corp.
Cleveland Wire Cloth & Mfg. Co.
National Wire Cloth Co.
W. S. Tyler Co.
Wickwire Spencer Steel Co.

Wire Rope
American Cable Co.
Broderick & Bascom Rope Co.
A. Leschen & Sons Rope Co.
Macwhyte Co.
Wickwire Spencer Steel Co.
Williamsport Wire Rope Co.

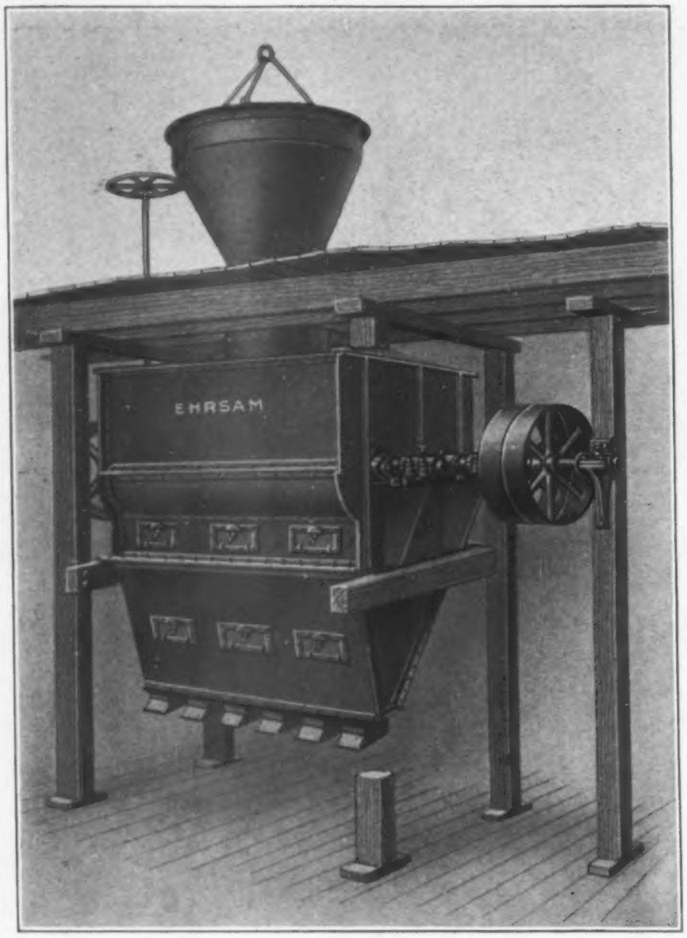
Wire Rope (Monel Metal)
Macwhyte Co.

Wire Rope (Non-Corrosive)
Macwhyte Co.

Wire Rope Fittings
American Cable Co.
Broderick & Bascom Rope Co.
A. Leschen & Sons Rope Co.
Macwhyte Co.
Williamsport Wire Rope Co.

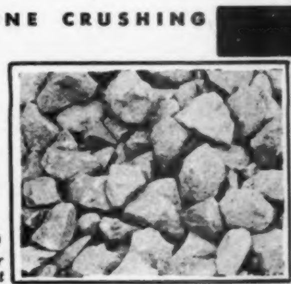
Wire Rope Slings (See Slings, Wire Rope)

Wire Rope Sockets (See Sockets, Wire Rope)



CUTAWAY VIEW
of a Williams "Jumbo Junior" Crusher, Showing Hammers and Sizing Grates

A Williams Crushed Product
(*Actual Photo*)
Note the cubular form of Product with no slivers and slabs.



Both samples taken from the same quarry

Ordinary Crushed Product
(*Actual Photo*)
Note slivers and slabs not crushed by a Williams crusher.

100 STANDARD BUCKETS..

Owen Buckets

..100 SPECIAL UNITS

We'll show you a bucket to handle any job, or design one and guarantee its performance.

THE OWEN BUCKET COMPANY
6040 Breakwater Avenue • Cleveland, Ohio
Branches: NEW YORK • PHILADELPHIA • CHICAGO • BERKELEY, CAL.

Type "D"

A mouthful at every bite

★

AMERICAN

HAMMERMILL CRUSHER

An exceptionally rugged crusher at a popular price. Here is a crusher that costs less to operate—less to maintain—but increases capacity in the production of a higher quality, consistently uniform material with minimum fines and no slivers or chips. Available in tonnages from 10 to 100 tons per hour.

WRITE FOR DETAILS

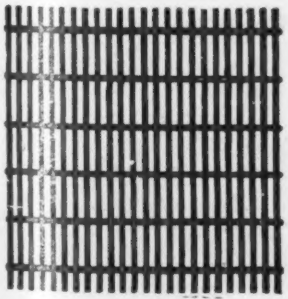
AMERICAN PULVERIZER CO.
1245 MACKLIND AVE. . . . ST. LOUIS, MO.

BARTLETT SNOW Froth-Flotation DUST COLLECTORS

• Eliminate wear, moving parts and get high recovery with a Bartlett-Snow Dust Collector. No manual supervision. No replacement of filtering units. No fire hazard. Trouble-free operation. Descriptive literature sent on request. The C. O. Bartlett & Snow Company, 6194 Harvard Avenue, Cleveland, Ohio. Representatives in the principal cities.

BARTLETT-SNOW
Dust Collectors

CONVEYORS • ELEVATORS • SKIP HOISTS • FEEDERS
CHAINS • SPROCKETS • DRYERS • COOLERS • SCREENS



Rolled Slat

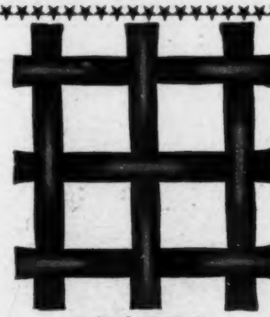
ALLOY No. 2

STAR PERFORMERS

CLEVELAND SCREENS are star performers—returning larger capacities, increased profits and more accurate separations at lower cost. Cleveland Screens save money with the initial investment because, if they are made of the longer-wearing, wear-resisting ALLOY NO. 2—Cleveland Screens stay on the job long after ordinary screens would have been replaced.

★ ★

THE CLEVELAND WIRE CLOTH & MFG. CO.
3574 E. 78TH STREET . . . . CLEVELAND, OHIO



2 Mesh .162 Ga.

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Free Service to Subscribers

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Rock Products and Cement and Engineering News
330 South Wells St., Chicago, Ill.

Please send me catalogs and prices concerning the items checked below:

....Air Compressors.
....Agitators.
....Anvils.
....Bags.
....Bag Printing Machines.
....Bagging Machines.
....Belt Dressings.
....Belting, Conveying.
....Belting, Transmission.
....Bins.
....Bin Gates.
....Blast Hole Drills.
....Blasting Powder.
....Block Machines.
....Bodies, Motor Trucks.
....Boilers.
....Brick Machines.
....Buckets.
....Buildings, Portable.
....Cable Coatings.
....Cableways.
....Calcining Machinery.
....Cars.
....Car Pullers.
....Car Replacers.
....Cement Brick Machines.
....Chain Drive.
....Chain Hoists.
....Chains, Steel.
....Classifiers.
....Clips, Wire Rope.
....Clutches.
....Compressors.
....Conveying Equipment.
....Conveyors.
....Cranes.
....Crusher Parts.
....Crushing Plants.
....Crushers.
....Derricks.
....Dragline Excavators.
....Dragline Cableway Excavators.
....Dredging Pumps.
....Drill Steel.
....Drill Sharpening Machinery.
....Drills, Blast Hole.
....Drills, Hand Hammer.
....Drills, Tripod.
....Dryers, Sand and Stone.
....Dynamite.
....Dump Bodies.
....Dump Cars.
....Dump Wagons.
....Dust Collecting Systems.
....Elevators and Conveyors.
....Elevating Equipment.
....Engineering Service.
....Engines, Gasoline.
....Engines, Oil.
....Fire Brick.
....Floor Tile Machines.
....Forges.
....Frogs and Switches.
....Gas Producers.
....Gear Speed Reducers.
....Gears.
....Generators, Electric.
....Hand Shovels.
....Hoisting Engines.
....Hoists.
....Hose, Air Drill.
....Hose, Pneumatic Tool.
....Hose,Steam.
....Hose, Water.
....Hydraulic Dredges.
....Industrial Railways.
....Lights, Carbide.
....Lime Hydrators.
....Lime Kilns.
....Loaders, Car.
....Loaders, Wagon.
....Locomotive Cranes.
....Locomotives, Electric.
....Locomotives, Gasoline.
....Locomotives, Steam.
....Locomotives, Storage Battery.
....Machine Shop Equipment.
....Magnetic Separators.
....Mixers.
....Motors.
....Motor Trucks.
....Moulds (Building Tile, Block, Burial Vault, Etc.).
....Oil Storage.
....Oils and Lubricants.
....Packing, Hydraulic.
....Packing, Piston.
....Packing, Sheet.
....Packing, Superheat.
....Paints and Coatings.
....Perforated Metal.
....Pipe Iron.
....Pipe, Machines.
....Power Transmitting Equipment.
....Pulleys.
....Pulverizers.
....Pumps, Centrifugal.
....Pumps, Electric.
....Pumps, Gasoline.
....Pumps, Steam.
....Pyrometers.
....Rails.
....Respirators.
....Rock Drills.
....Roofing Tile Machines.
....Rope Drive.
....Rope, Manila.
....Safety Clothing, Etc.
....Sand-Lime Brick Machinery.
....Sand Pumps.
....Sand Washing Boxes.
....Scrapers.
....Screening Equipment.
....Screening Plants.
....Screens.
....Sheaves.
....Steam Shovels.
....Steel, High Speed.
....Steel, Manganese.
....Stokers, Automatic.
....Tanks, Steel.
....Tanks, Wood.
....Tracks.
....Track Material.
....Transformers, Electric.
....Unloaders.
....Valves.
....Washing Equipment.
....Weighing Equipment.
....Welding, Electric.
....Welding, Oxy-Acetylene.
....Winches.
....Wire Cloth.
....Wire Rope.
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POSITIONS WANTED — POSITIONS VACANT—two cents a word. Set in six-point type. Minimum $1.00 each insertion, payable in advance.

INFORMATION
Box numbers in care of our office. An advertising inch is measured vertically in one column. Three columns, 30 inches to the page.

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Used Equipment for Sale

CONSOLIDATED GOOD USED EQUIPMENT

ROTARY KILNS SPECIAL

2—8′x125′ P. & M. Rotary Kilns.
4—8′x110′ Bonnot Rotary Kilns.
1—6′x60′ Rotary Kiln. At Martins Ferry, Ohio. Must be shipped within 15 days as premises have been rented.

4—Raymond High Side Roller Mills with air separation. One 3-roll and one 5-roll.
Equipped with Latest Oil Journals.
4—Raymond Pulverizers, No. 0000, 00, No. 1, 3.
3—8′x8′, 6x6, 6x4 Oliver Filters, steel.
1—3′x20′ Ruggles-Coles F-1 Rotary Dryer, complete.
12—Rotary Dryers, 4′x30′, 5x26, 5x30, 6x50, 6x60, 8′8″x85′.
5—Hardinge Iron Lined Ball Mills, 3′x8″, 4½′x16″, 6′x22″. Also other sizes.
1—4′x8′ Kennedy steel lined Ball Mill.
2—24″x20″ Jeffrey type "B" Hammer Mills.
1—36″x36″ 4XC Gruendler Hammer Mill, roller bearings.
3—5′x22′ Gates silex lined Tube Mills.
1—3′x12′ Hendy Tube Mill, iron lined.
3—4′x5′ Tyler Hummer Screens, No. 31 triple deck; 3—4′x7′ No. 60 double deck; 3x5 and 4′x5′ single deck. Also all other makes of vibrating screens.
2—Sturtevant Crushing Rolls 36x16, 20x14″.
1—18″x36″ McLanahan Single Roll Crusher, with Tex-rope drive and 25 H.P. Motor.

Just a Partial List

SEND FOR BULLETIN of our regular stock of Crushers; Vibrating Screens; Ball, Rod and Tube Mills; Air Compressors; Rotary Kilns and Dryers; Hardinge Ball and Pebble Mills; Raymond and other Pulverizers; Air Classifiers; Thickeners; Wet Classifiers; Filter Presses; Continuous Filters, etc.

CONSOLIDATED PRODUCTS COMPANY, INC.
15-16-17 Park Row **New York, N. Y.**
Plant and Shops at Newark, N. J., cover 8 acres of ground.

CARS

12-Yd. Western Air, also Hand Dump Cars, Flats, Gondolas, Steel Hopper Cars, Box Cars, Locomotives.

HYMAN-MICHAELS COMPANY
20 N. Wacker Dr. Bldg., Chicago, Ill.
Railway Exch. Bldg. St. Louis, Mo. **101 West 31st St. New York**

STEAM LOCOMOTIVE BARGAIN

Customer's Financial inability leaves on our hands
1 STEAM LOCOMOTIVE, 21 TON, 11″x16″ Will dispose at bargain price. NEW!
Also offer
1 DAVENPORT DIESEL-ELECTRIC, 15-ton NEW! PRICED TO SELL!

Davenport Locomotive Works
Builders of Steam, Gas & Diesel Mechanical, Gas & Diesel Electric Locomotives
2405 Rockingham Rd., Davenport, Iowa

LIQUIDATION AT NEW CASTLE, PENN.

1—6′6″x75′ Mosser Rotary Kiln, complete, oil fired.
1—Raymond Midget three roller Mill, complete, motor driven.
1—Erie City 150 H.P. Economic type Boiler.
1—Jeffrey Conveyor System (25′ bucket elevator, 2-20′ and 50′ Drag Conveyors).
20—Motors, 5 to 50 H.P., 3 phase, 60 cycle, 220 volts.
1—Carrier four truck Tunnel Ejector Dryer.
1—10-ton Howe Truck Scale.
1—Allis-Chalmers No. 6K Gyratory Crusher.
1—Set Traylor Crushing Rolls.
2—Rotary Screens, 3′ dia. x 10′ long, 4′ dia. x 6′ long.
1—4½′x12′ Abbe Tube Mill.
40 tons 100-lb. Rail; 22 tons 40-lb. Rail.
1—Erie type "A" caterpillar Shovel.
1—McMyler Manufacturing Co. standard Gauge Crane.
4—36″ gauge Dump Cars.
Miscellaneous Pumps, bucket and belt conveyors, Shafting, Piping, Conduit, etc., etc.

Inspection Invited! Prices on Request!

STEIN-BRILL CORPORATION
183 Varick Street . . . New York, N. Y.

Haiss-Fordson Digging Loader on Wheels.
Buda 35 HP. 4-cyl. Engine with Pulley.
Centrifugal Electric Pump, 8″ inlet, 6″ outlet.
Kennedy Van Saun Gyratory Crusher No. 37.
Chain Elevators with 10″ and 12″ buckets.
Hummer 2-deck 3x5′ Vibrating Screen.
Jeffrey No. 3 Jaw Crusher with Hammer Mill.
Swivel ¾-yd. Dump Cars, 24″ gauge.
Portable Track, Switches, Cars, Locomotives.
Hoists, Air Compressors, Rock Drills, Skips.
Trippers for 18″ and 24″ Belt Conveyors.
Robins 30″ Pulleys and 150 Trough Idlers.
500 Selected Belt Idlers 18″, 24″, 30″ & 36″.
Robins 24″x115′ Conveyor with Belt.
Hayward 1-yd. Clamshell Bucket.
Owen ¾-yd. Clamshell Bucket.
Gardner-Denver Portable Air Compressor, 160′.
I.R. 2-Stage Belted Air Compressor, 446′.
Domestic 6″ Self-Priming Cent. Pump, Buda.

G. A. Unverzagt, 15 Park Row, New York City

60, 80, 180 and 360 HP. Diesel Engines.
4—750 HP. Busch Sulzer Diesel Units.
15-ton 70-ft. Boom Stiff Leg Derrick.
Bonnot 4x22 Tube Mill & Traylor 6x8.
750-yd., 1250-yd. and 2000-yd. Asphalt Plants.
2—1¼-yd. Thew Steam Shovels.
Champion 1030 & 1040 Roller Bear. Jaw Crushers.
Pennsylvania SX4, SX6 and SXT12 Hammermills.
150-ton 50-ft. R.R. Track Scale.
Superior 10-in. and 36-in. McCully Crushers.
Traylor 4—10TZ Reduction Crusher.
3—14-ton Plymouth Gasoline Locomotives.
8—3-yd. Koppel V-Shape, 36-Ga. Dump Cars.
Jaw Crushers: 60x84, 42x36, 42x40 and 36x24.
77-B Lorain 1½ yd. Diesel Shovel.
2—6′9″x8′ Horizontal Batch Tumbling Mill.
3300 ft. I.R. Class PRE-2 Elec. Air Compressor.
2040 ft. I.R. Class PRE-2 Elec. Air Compressor.
1730 ft. Bury 1927 Model Elec. Air Compressor.
1040 ft. Chgo. Pneu. Diesel Air Compressor.
676 ft. Worthington Duplex Elec. Air Compressor.
2 Marion 450 Diesel Shovels 1¼ yd.

Hummer Vibrating Screens

4—4x5 Single Frame, Double Deck.
2—4x5 Side by Side Double Deck.
1—4x5 Tandem (4x10) Single Deck.
1—4x6 Side by Side Double, Single Deck.
20—Vibrators V-16 and V-32.
2—7½ HP, 3 P., 60 C., 220 V.—32 V. DC MG Sets.

R. C. STANHOPE, INC.
875 Sixth Avenue **New York, N. Y.**

FOR SALE

30-ton American 4-wheel saddle tank locomotive, 12x18″ cylinders.
33-ton Vulcan 4-wheel saddle tank locomotive, 13x18″ cylinders, (Two Duplicates).
36-ton Porter 4-wheel saddle tank locomotives, 14x20″ cylinders, (Two Duplicates).
40-ton Baldwin 4-wheel saddle tank locomotives, 14x22″ cylinders, (Five duplicates).
40-ton Vulcan 4-wheel saddle tank locomotives, 14x22″ cylinders, (Two Duplicates).
50-ton American 4-wheel saddle tank locomotives, 16x24″ cylinders, (Three Duplicates).
55-ton Baldwin 4-wheel saddle tank locomotive, 18x24″ cylinders.
60-ton Baldwin 6-wheel saddle tank locomotive, 18x24″ cylinders.
70-ton American 6-wheel switching locomotive with separate tender, 20x26″ cylinders, (Two Duplicates).
100-ton American 8-wheel switching locomotive with separate tender, 23x28″ cylinders.

Complete stock list on request.

BIRMINGHAM RAIL & LOCOMOTIVE COMPANY
BIRMINGHAM, ALA.

LIQUIDATION SALE

The items shown below are a few of those included in the equipment and machinery of a large modern stone crushing plant being liquidated. These and all other items are available at liquidation prices:

1—5½ foot Symons Cone Crusher—Shop No. 520—9″ Shaft—Bronze Bearings.
2—Type 10 I. R. Air Compressors. Air Cylinders, 19 x 16 and 12 x 16—16 x 14 and 10 x 14.
1—Type 37 Marion Steam Shovel—Serial No. 5295. Mounted on crawling tractor trucks.
3—36″ Gauge Gasoline Locomotives:
1—Plymouth—Shop No. 1562.
1—Vulcan—Shop No. 3608
1—Whitcomb—Shop No. 13063.
1—I. R. Drill Sharpener No. 50, with dies, dollies, gauges and formers.
18—Western and Continental 4 and 5 Yard Double Side Dump Cars.

For complete inventory and quotations address

F. G. HAMBLEN, AGENT
P. O. Box 572, Greenville, S. C.

1—Marion 32 Steam Shovel on crawlers 1¼-yd.
1—Erie Gas-Air 1¼-yd. Shovel
1—No. 8 Austin Gyratory Crusher with Elevator
2—42-B Barber-Greene Loaders
2—28-E Foote Pavers
1—18′x20′ Lakewood Double Screed Finisher with drop screed for brick
1—Lakewood 20′ Subgrader

New and Used Equipment. Tell us what you need.

THE T. J. LANE CO.
Box 665 **Springfield, Ohio**

(Classified Advertising Continued on Next Page)

Continued from Preceding Page

USED EQUIPMENT

FOR SALE

1—2-yd. Monighan Dragline, 80′ & 60′ booms.
1—30″x42″ Type C Buchanan Crusher.
1—2-deck Traylor Jeffrey Vibrating Screen, size 47″x84″.
Sand rolls—1 set 36″x16″, 1 set 27″x14″.
1—2-yd. Smith Mixer.
2-Yd. Blaw-Knox Weighing Batchers, 3 compartment bin.
300-ft. Insley Steel Tower, heavy duty, with skip and chutes.
2—60″x24′ revolving screens.
1—48″x24′ revolving screen.
12″ Centrifugal Pump. Also other 4″ and 6″ pumps.
Sauerman 1-yd Cableway, complete.
Austin Trench Machines.
75 KVA Generator, 900 RPM.
30″ Belt Conveyor, various electric motors, and gear reducers.
1—240 H.P. Fairbanks-Morse Full Diesel Engine.

The Gordon Construction Co.
1900 31st St. Denver, Colorado

USED EQUIPMENT BARGAINS

1—O & S 50 H.P. Steam Hoist, 2-drum, 10x12	$ 650.00
2—6-ton Whitcomb 24″ Gauge Locomotives, each	350.00
1—O & S ⅝-yd. Crane, 35-ft. boom	1000.00
11—5-yard Continental and Western 36″ Gauge Side Dump Cars, ea.	100.00
1—Domestic Centrifugal 4″ Pump	250.00
1—Avery 4″ Centrifugal Pump	350.00
1—Barnes 4″ Double Diaphragm Pump	250.00
1—Gould Single Diaphragm Pump	125.00

Write or Wire for Quantity and Cash Discount

All items are offered F.O.B. St. Louis, in good operating condition and subject to prior sale.

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1325 Macklind Ave., St. Louis, Mo.

AC MOTORS
50HP. 900, 3/60/220 Fair.-Morse slip ring.
75HP. 900, 3/60/440 Gen. Elec. sqr. cage.
100HP. 900, 3/60/220 Allis-Chal. sqr. cage.
100HP. 900, 3/60/2200 Fair.-Morse slip ring.
100HP. 720, 3/60/220 West'house slip ring.
200HP. 600, 3/60/440 Elec. Machy. synchr.

AC GENERATORS
15KW. 1800, 3/60/220 Roth dir. con. exc.
50KVA. 1200, 3/60/2300 Bullock dir. con. exciter.
240KW. 720, 3/60/440 Gen. Elec. 3 bearing.

TRANSFORMERS
3-100KVA. Wagner 1/60cy. 2300-230/460 v.
3-250KVA. Wagner 1/60cy. 2200-220/440 v.

DIESEL GENERATOR
47KVA. 3/60/2400 V. Fair.-Morse Y style VA.

AIR COMPRESSORS
92 CFM. I-R class ER-1 7x6.
327 CFM. I-R 2 stage 12&7½x12.
599 CFM. I-R 2 stage 16&10x14.

CENTRIFUGAL PUMPS
375 GPM. 30-lb. pres. Advance belted type.
1000 GPM. 170′ head Amer. 2 stage belted.

ROCKFORD ELECTRIC EQUIPMENT CO.
710 South Wyman St. Rockford, Ill.

ELECTRICAL MACHINERY

Motors and Generators, A.C. and D.C., for sale at attractive prices. New and Rebuilt. All fully guaranteed. Write for List and Prices.

V. M. NUSSBAUM & CO.,
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90′ Sauerman Mast, 1-yd. Sauerman Bucket, two-speed Thomas Hoist with 60 H.P. electric motor; also compensator, complete set of sheave blocks and cables. All in A-1 condition.

F. H. BAILEY & SONS
KENTON OHIO

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GEORGE HAISS MFG. CO., Inc. **HAISS** Park Ave. and 143rd St. New York

Send me full details and prices on equipment checked

FACTORY REBUILT CLAM SHELL BUCKETS
☐ 1—Haiss ½-yd. HiPower Digging Bucket.
☐ 1—Owen 2½-yd. Type "S" Bucket.
☐ 1—Owen ¾-yd. Type "D" Bucket.
☐ 1—Haiss 1-yd. Contractor Type Bucket.
☐ 1—Blaw Knox ½-yd. Lever Arm Bucket w. teeth.
☐ 1—Hayward ½-yd. Type "E" Bucket.

FACTORY REBUILT TRUC' LOADERS, BELT CONVEYOR, ETC.
☐ 1—Haiss 2-yd. a min. Creeper Truck Loader.
☐ 1—Haiss 1¼-yd. a min. Creeper Truck Loader.
☐ 1—Haiss 25′ 16″ Trough Conveyor, Gas-Elec.
☐ 1—Snow Plow Model 10A Champion 8′ wide, new $80.

Name ....
Address ....

FOR SALE

LOCOMOTIVE, 1 5-ton Vulcan, Loco. No. 3872, Engine No. 43793, 36″ gauge. Used one season.

SIDE DUMP CARS, 16, 36″ gauge, all steel 1½-yd.

All equipment in good condition.

Address Box 716, care of Rock Products, 330 South Wells Street, Chicago, Ill.

Jaw Crushers—2″x6″ up to 66″x84″.
Crushing Rolls—12″x12″ up to 54″x24″—Gyratory Crushers—No. 3 up to 42″.
Ring Roll Mills — No. 0 and No. 1 — Swing Hammer Mills.
Rotary Fine Crushers—No. 1, No. 1½, No. 2.
Direct Heat Rotary Dryers—4′x30′, 5′x30′, 5½′x40′, 6′x50′, and 3½′x25′.
Semi-indirect Heat Dryers, 4′x30′, 4½′x26′, 5′x30′ and 8½′x75′.
Cement Kilns—3′ up to 9½′ diameter.
Hardinge—Marcy & Fuller—Lehigh Mills.
Raymond Mills—No. 00, No. 0, No. 1 & No. 3 roll.
Tube—Rod and Ball Mills—4′ to 8′ diameter.
New dryers made for all purposes.
2—8′x72″ Hardinge Mills—90% new.
Air Compressors—One No. 27 I-R oil furnace for drills—Cranes—Shovels.

W. P. HEINEKEN
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WELDING OUTFITS
$6.00 to $72.00
EASY TERMS
MONTHS TO PAY

SUPERIOR OXY-ACETYLENE MACHINE CO.
Hamilton, Ohio

SAMPLES ONLY—SEND FOR BULLETIN
200 HP G. E. 720 rpm 2300 v. I-K Motor.
2—125 H.R.T. Boilers with Stokers.
150 HP Worthington Diesel Engine.
20 ton Brownhoist Loco. Crane. ASME.
1½ yd. Moore "Speedcrane". Overhauled.
No. 3 Symons Cone-Gyratory & Jaw Crushers.

MISSISSIPPI VALLEY EQUIPMENT CO.
515 Locust St. St. Louis, Mo.
Headquarters for Quarry and Power Equipment

USED EQUIPMENT

FOR SALE

12—5-yd. 36″ ga. Western Dump Cars.
6—2-yd. 36″ ga. Koppel Steel V Dump Cars.
4—1½-yd. 36″ ga. Insley Steel V Dump Cars.
2—3½-ton 36″ ga. Whitcomb Gasoline Locomotives.
1—9x10 Sturtevant Vertical Steam Engine.
1—10x10x12 Ingersoll Steam-Driven Air Compressor.
1—9x10 Lidgerwood 3-Drum Steam Hoist.
1—8¼x8 Lidgerwood S.D. Steam Hoist.
22—12-yd. Western std. ga. Air or Hand Dump Cars.
2—40-ton Baldwin S.T. Locomotives, 14x22 cyls.
Rails—First-Class Relay Rails and Bars, 60, 70, 80, 85, 90 and 100 lb. Rails, Tie Plates, etc.

HYMAN-MICHAELS CO.
20 N. Wacker Dr. Bldg., Chicago
Railway Exchange Bldg. St. Louis, Mo. 101 West 31st St. New York

SURPLUS EQUIPMENT FOR SALE

Air Compressor—I.-R.—Steam	$ 350.00
Crane, Ohio Steam Loco., 15 Tons	2,500.00
Derrick, McMyler "A" Frame, 15 Tons	1,000.00
Drills, No. 14 Cyclone Well, 6″	250.00
Dump Cars—3¾- & 4-Yd. Side dump	25.00
Generator, 25 K.W. Steam	400.00
Pump—12″ A.M.S. Sand & Gravel W/250 H.P. Motor, Controls, etc.	4,000.00
Scales—Howe 200 T. track, 20 T. truck & Platform	....
Shovel, No. 80 Marion Steam	1,000.00
Transformers, Maloney Elec. 100 K.V.A., high 33,000, low 220—460—60 Cycle	350.00

MO. PORTLAND CEMENT CO.
St. Louis, Mo.

FOR SALE

Oldest and largest deposit of Blast Furnace slag in Eastern part of United States. Bank contains large amount of iron. For full particulars address **Box 742, care of Rock Products, 330 S. Wells St., Chicago, Ill.**

RAILS AND CARS

All weights, new and used rails, 12 lbs. to 100 lbs. Portable track, drier cars, all gauges—"V" shape and Western Cars. In centrally located warehouses. Wire or write for prices.

M. K. FRANK
480 Lexington Ave. New York City — P. O. Box 1234, Pittsburgh, Pa.

POWER UNIT BARGAINS	Each
5 25-HP New Waukesha Power Units	$175.00
3 40-HP New Climax Power Units	375.00
1 60-HP Rebuilt Climax Power Unit	400.00
1 75-HP Twin City Power Unit	650.00
1 100-HP Rebuilt Wisconsin Power Unit.	

35-HP, 50-HP, 100-HP, & 225-HP Diesel Engines. (The above engines can be furnished with or without electric generating outfits.)

Triangle Engrg. Co., 53 W. Jackson, Chicago

FOR SALE

No. 4 Gates Gyratory Crusher, equipped with Traylor TZ non-chokable Bell Head and curved concaves. Replacing with larger crusher. Capacity approximately 15 to 20 tons, reduction to minus 1 inch. Good condition. Reasonable price.

G. & W. H. CORSON
Plymouth Meeting, Pa.

"E. C. A. REBUILT" QUARRY and GRAVEL PLANT EQUIPMENT

AIR COMPRESSORS

Portable and stationary, belt, with elec. or gas. power, sizes from 21 cu. ft. to 1,000 cu. ft.

BUCKETS

246—Buckets, all sizes and makes.

CARS

Large lot including std. ga. 6- and 12-yd. and 20-yd., 36-ga. 5-yd., and 24-ga. 1½-yd. Also std. ga. flat cars and ballast cars.

CONVEYORS and ELEVATORS

9—Port. belt conveyors with steel frame, gas. or elec. pr. 18 and 24 in. Barber-Greene and Chic. Automatic.

11—Bucket elevators: 6 Chain Belt Co., Weller and Link-Belt vertical enclosed type; capacities from 35 to 117 tons per hour. 5—Weller inclined type. Nos. 3, 4, 5 and 6 up to 170 yds. per hr.

CRANES (Locomotive)

5—Locomotive cranes; sta. ga., 30 and 25 tons; Ohio, Browning, American, Industrial.

CRANES and DRAGLINES

1—Industrial Brownhoist Model DC Diesel crane, Serial 5176, 60-ft. boom, 1¼-yd. bucket.

2—Osgood No. 2054, 2069, with 40-ft. boom, 1 with 1-yd. shovel front.

1—Brownhoist No. 2, Ser. 9964, 40-ft. boom, 1-yd. bucket.

1—Byers Bearcat crane, ½-circle swing, 30' boom, ½-yd. bucket.

CRUSHERS

1—Symons coarse cone crusher, size No. 5½, SU No. 521.

1—Set P & M crushing rolls, size 42x16".

1—Allis-Chalmers Gates No. 6.

1—Austin No. 6, Serial 2836.

1—Austin No. 5, Serial 1960.

2—McCulley No. 3 gyratory.

DERRICKS

Steel and wood, stiff leg, or guy; from 2 to 50 tons, including 2 steel stiff legs.

DRILLS and DRILL SHARPENERS

3—Gardner Denver wagon or derrick drills with Model 21 or 17 Gardner drills for channelling.

25—Ingersoll-Rand and Sullivan jackhammer, column, and tripod drills.

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(Electric and Gas)

55—Electric, ranging from 20 HP. up to 125 HP., consisting of triple-drum, double-drum and single-drum with A.C. or D.C. mtrs., some with attached swingers.

38—Gas hoists, ranging from 8 to 120 HP., single, double and triple-drums; all standard makes.

LOCOMOTIVES

32—Gasoline locomotives from 14-ton to 2-ton standard 36 and 24-ga.

3—Steam saddle tank locomotives; 1—24-ton Porter, cyl. 12x16"; standard ga., Ser. No. 5093; 1—19-ton Davenport, cyl. 10x16 std. ga. Ser. No. 2036; 1—20-ton Porter, cyl. 11x16, 36-ga. Ser. No. 6753.

PUMPS

All sizes and types, both force, centrifugal and steam. 4 dredge pumps, belt-driven: 1—8" Morris, 1—6" Morris manganese, 1—6" Erie, 1—4" Morris.

SHOVELS

1—P&H Model 600, 1-yd., Ser. 2750.

1—Osgood, 1-yd., Ser. 2069.

1—P&H Model 300, ½-yd., Ser. 3660.

1—Speeder combination ½-yd. shovel & crane.

3—Link-Belt shovel attachments for K-55, K-44, K-42, K-38 or K-2.

USED EQUIPMENT

Hummer Heavy-Duty Vibrating Screens

4 Single Units 4'x5'—2-Deck with V-16 Vibrators.
2 Double Units 4'x5'—2-Deck with 2 V-32 Vibrators.
1 Tandem Unit 4'x5'—1-Deck with 2 V-32 Vibrators.
1 Double Unit 4'x6'—1-Deck with 4 V-32 Vibrators.
2 Tyler 7½-hp. A.C. Motor Generator Sets.
G. A. Unverzagt, 15 Park Row, New York City

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For Sale—Two Loomis Clipper 44, electric well drills with rear crawlers. One wire line, one manila line. Both in excellent condition. Bargain for quick sale. Located eastern Pennsylvania.

Frank Swabb Equipment Co., Hazleton, Pa.

FOR SALE

2½ yd. Beaumont cable track dragline, with 80 ft. steel mast. Two speed 150 H.P. Hoist. 440 volt.

MANNING & LOCKLIN NORTHVILLE COMPANY
502 Lincoln Blvd. Detroit, Michigan

USED EQUIPMENT WANTED

WANTED—Several Raymond or Williams roller mills of various sizes to be rebuilt for export. Condition immaterial, but must be cheap for cash. Describe fully. Address
Box 696 care of Rock Products
330 South Wells St. Chicago, Ill.

WANTED

Used cement briquette machine, moulds, scales, sieves, chemical laboratory equipment, small ball mill and crusher. **Address Box 743, care of Rock Products, 330 S. Wells St., Chicago, Ill.**

USED EQUIPMENT

BARGAINS FIRST CLASS EQUIPMENT

1—⅜-yd. Byers Bear Cat Jr. Combination Shovel-Dragline, practically new, latest type, $2500.

1—⅝-yd. P & H 300 Combination Shovel-Dragline. Overhauled. $2500.

1—1¼-yd. Byers Crane-Dragline. Late Model. $7500.

1—15x36 Cedar Rapids Portable Crushing Plant, including elevator, screen. Overhauled at a cost of $1500. Guaranteed. $3000.

WENZEL-KENNEY MACHINERY CO.
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BUSINESS OPPORTUNITIES

WANTED TO BUY

Small stone quarry or gravel plant. Will consider purchase of half-interest. Advise full particulars first letter. Address Box 741, care of Rock Products, 330 S. Wells St., Chicago, Ill.

We have one 10" and one 8" complete Hydraulic Dredge plant for sale. Swintek Cutters and Allen Cone Separators making four grades of sand, as many gravel grades as wanted. 3 electric cranes. May consider partnership in good neighborhood. 20 years in sand business.

BROADWAY CONSTRUCTION CO.
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Representatives wanted to sell on commission basis a high grade wire cloth used extensively in sand, gravel, stone, coke plants, cement mills, etc. Address Box 707, care of Rock Products, 330 S. Wells Street, Chicago, Ill.

If you have capital to invest in a good business, or are seeking additional capital to increase your production, try an advertisement in this section.

CONSULTING ENGINEERS

WE LOOK INTO THE EARTH

By using Diamond Core Drills. We drill for Limestone, Gypsum, Talc, Fire Clay, Coal and all other minerals.
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H. D. RUHM
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Dealer in PHOSPHATE LANDS and all grades of rock.
10-mesh PHOSPHATE FILLER, $3.00 net ton
40 years' experience TENNESSEE PHOSPHATE FIELD. Correspondence solicited. Can find what you want if it can be found.
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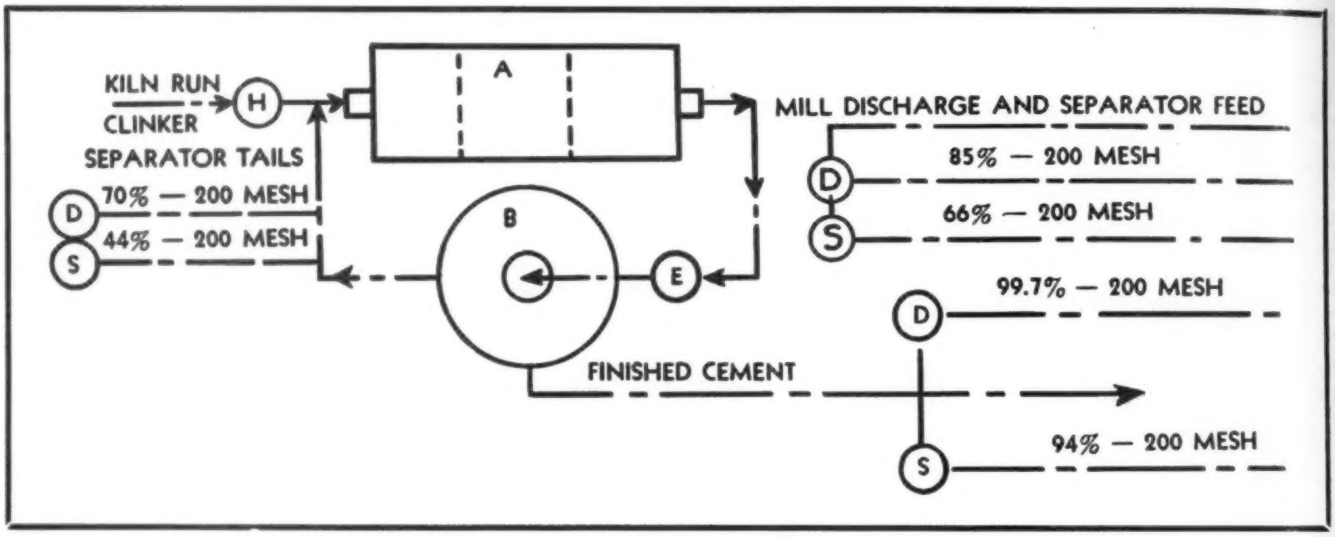
WHEN in need of advice on difficult problems of our industry, write the advertisers in this department.

POSITIONS WANTED

LIME PLANT SUPERINTENDENT—Desires a permanent connection, 15 years experience in operating lime & crushing plants, limestone quarries. Also have years experiences in burning of lime in vertical and rotary kilns. Experience in combustion problems of rotary and vertical kilns. First class mechanic. Employed at present. Excellent references. Address Box 671, care of Rock Products, 330 S. Wells St., Chicago, Ill.

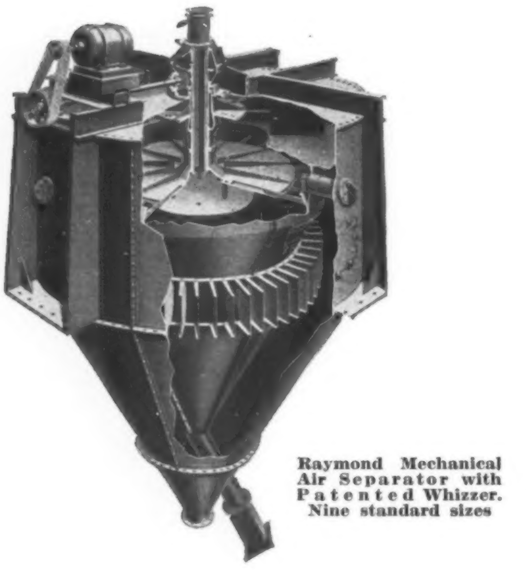
SUPERINTENDENT DESIRES A PERMANENT connection with a progressive crushed stone company. 20 years practical experience in operating trap rock or limestone quarries and crushing plants. Familiar with all modern equipment. Capable of taking full charge of any proposition. Prefers connection where eventually he could purchase a substantial interest. Unquestionable references. Open for engagement. Address Box 777, care of Rock Products, 330 S. Wells St., Chicago, Ill.

Another RAYMOND Record in Separating CEMENT



A, 3-Compartment mill. B, Raymond separator. D, High early strength cement. S, Standard Portland cement. E, Elevator. H, Mill feed hoppers.

44% More Capacity—20% Less Power



Raymond Mechanical Air Separator with Patented Whizzer. Nine standard sizes

THE superior results, being obtained in cement plants with Whizzer-type Mechanical Air Separators, are shown by these operating figures taken at random from a typical installation among the many Raymond units used by leading manufacturers of both standard Portland and high early strength cement.

The equipment includes a 16′ Raymond Separator in closed circuit with a 7′x45′ three-compartment mill.

	Open (Std)	Closed (Std)	Closed (H. E. S.)
Total Capacity..........	90 bbl/hr	130 bbl/hr	85 bbl/hr
Finished Fineness.......	88%—200 mesh	94%—200 mesh	99.7%—200 mesh
Flour Content...... ...	51%—30 microns	54%—30 microns	....
Power per Barrel........	6.28 KW	4.99 KW	7.58 KW
	No Separator	With Separator	With Separator

Note that the total output is increased 44% by the use of the Raymond Whizzer Separator in making the Standard Portland Cement, also the better quality shown by the higher fineness and micron count.

For performance records on other installations, see No. 24 Separator Bulletin—copy sent on request.

RAYMOND BROS. IMPACT PULVERIZER CO.

Division of Combustion Engineering Company, Inc.
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Sales Offices in all Principal Cities
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Maximum Recovery of Fines—High "Flour" Content